

Bootstrapping Our Collective Intelligence

Turing Lecture

CSCW'98 Seattle, Wa.

Nov. 16, 1998

Douglas C. Engelbart

BOOTSTRAP INSTITUTE

<http://www.bootstrap.org>

Exploding Rate and Scale of Change



Exploding Rate and Scale of Change

- **Problems**
 - Vicious cycle of urgency and complexity
 - Wrenching, global change
 - And more ...
- **Opportunities**
 - Boosting our capacity for effective collective action
 - Boosting our capacity to keep improving
 - And more ...

Going After the Opportunities

**ABCs of
Improvement**

**Improvement
Communities**

**Collective
Intelligence**

Bootstrapping

**Co-Evolution
Frontier**

Going After the Opportunities

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**Co-Evolution
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Organizational Capability Comes From ...

TOOL SYSTEM



Facilities

Media

Tools

Machinery

Vehicles

Etc.

Basic Genetic Human Capabilities

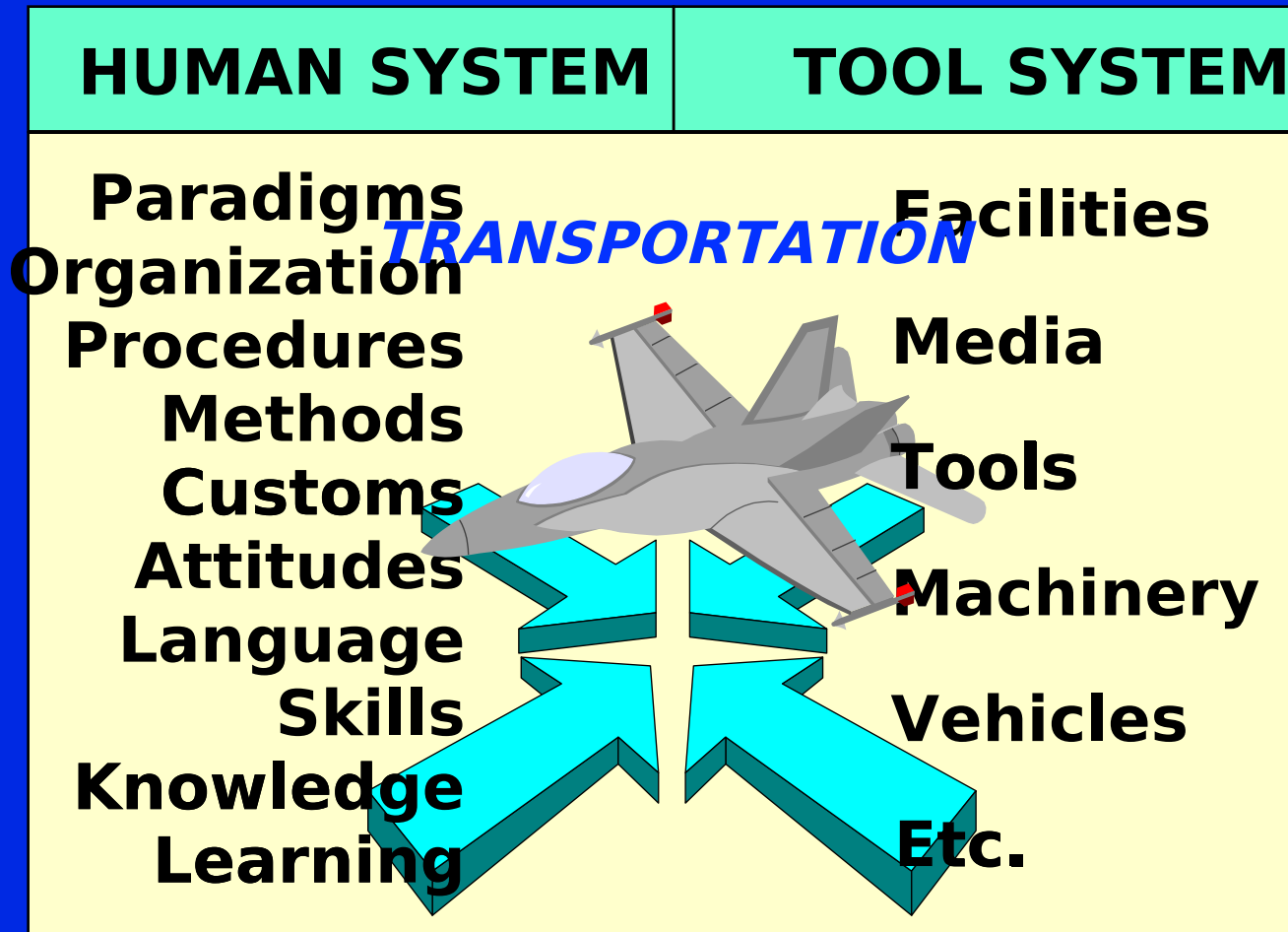
Organizational Capability Comes From ...

HUMAN SYSTEM	TOOL SYSTEM
Paradigms Organization Procedures Methods Customs Attitudes Language Skills Knowledge Learning	Facilities Media Tools Machinery Vehicles Etc.



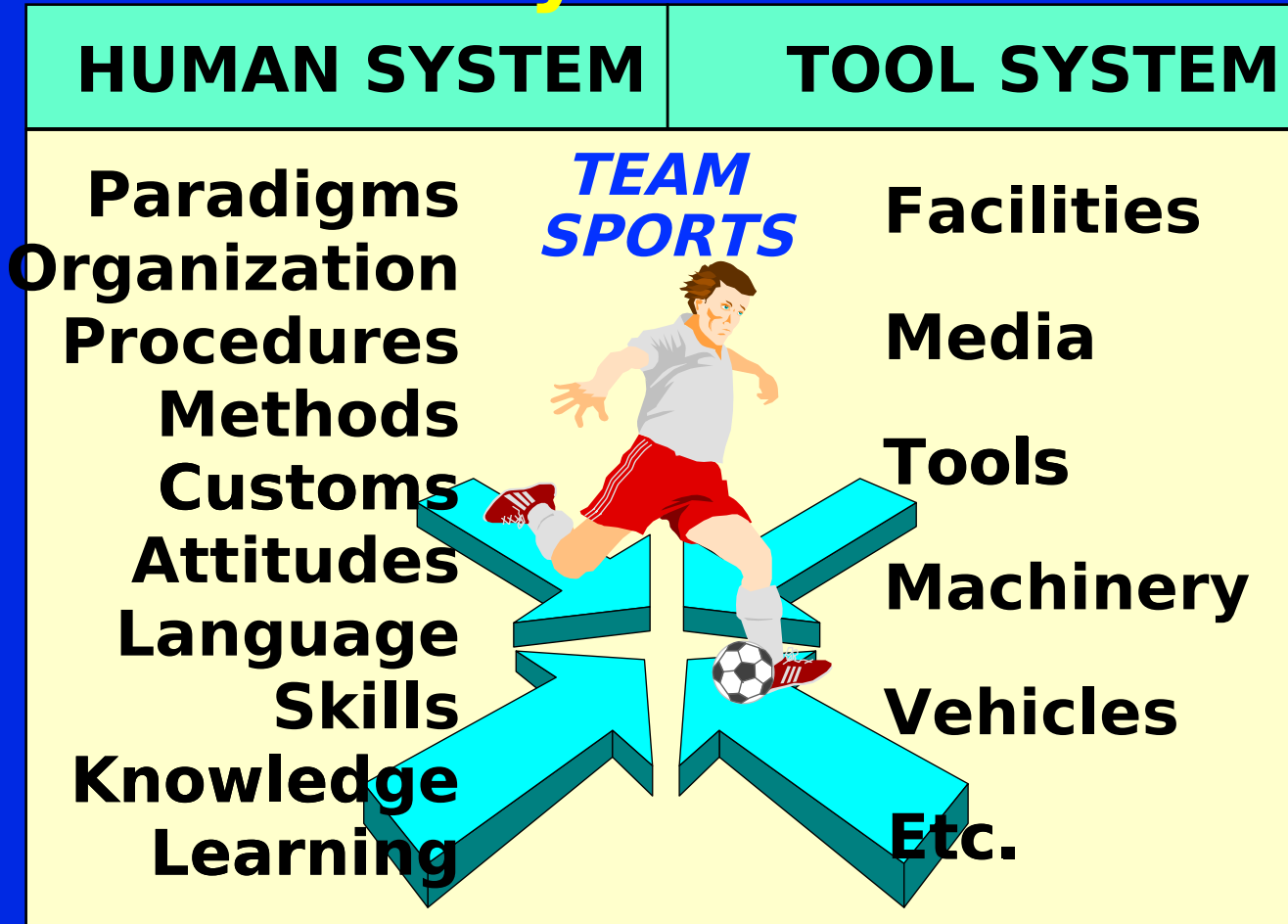
Basic Genetic Human Capabilities

Capabilities Augmented via Co-Evolution of Human and Tool Systems



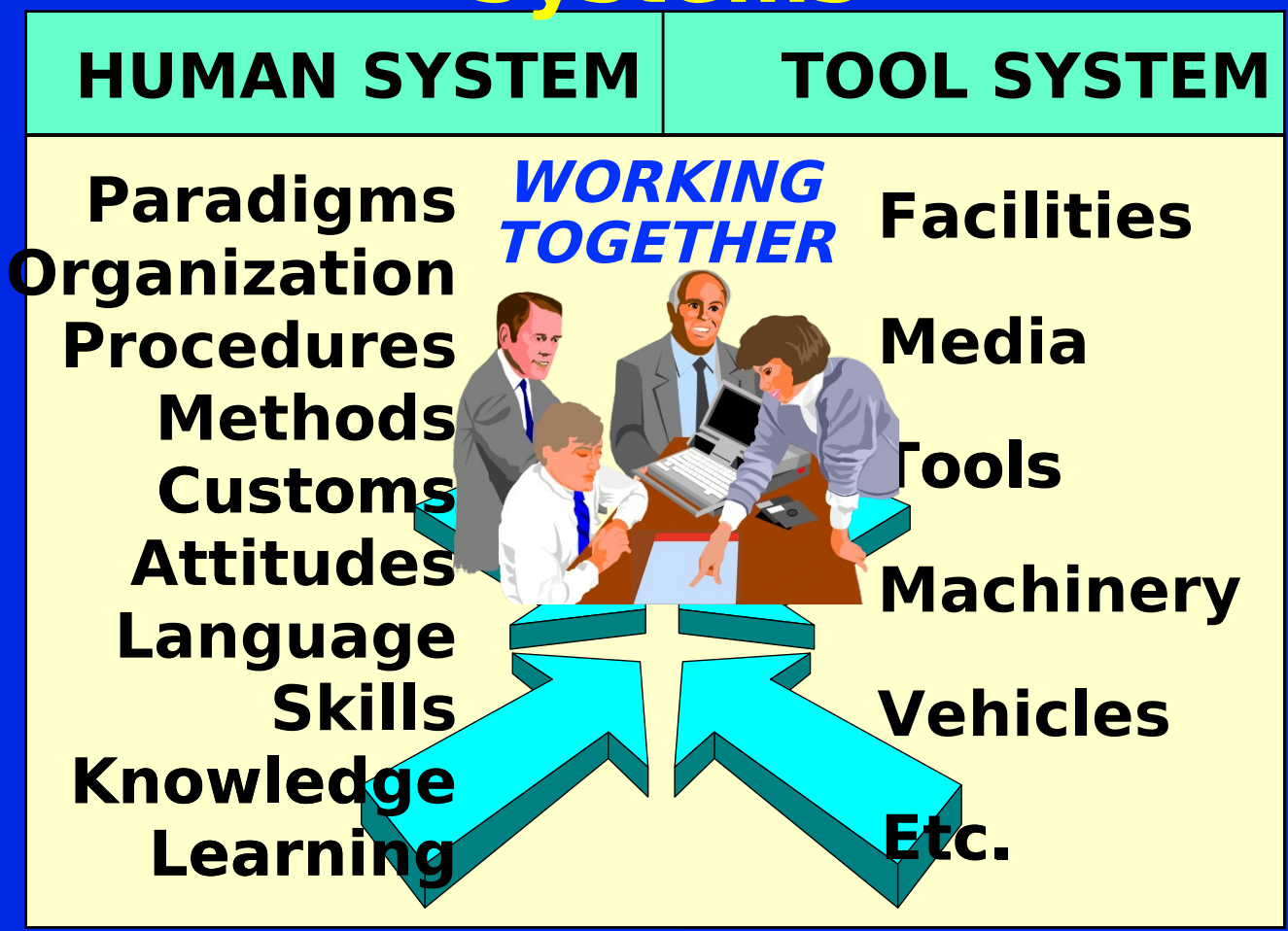
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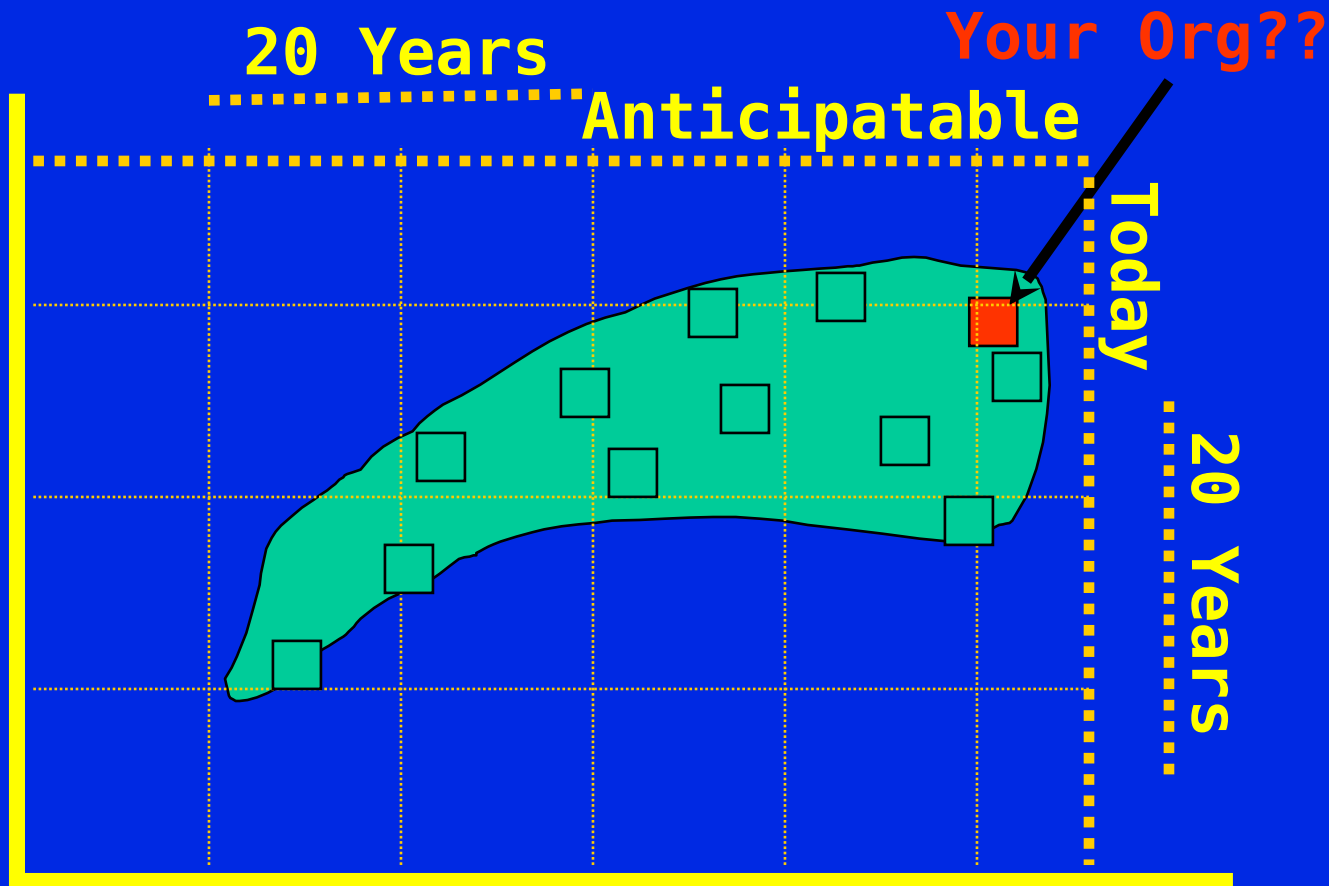
Capabilities Augmented via Co-Evolution of Human and Tool Systems



Basic Genetic Human Capabilities

The World's Organizations in Human-Tool Space

Human System Development



1

Tool System Utilization

Co-Evolution Frontier: “Advanced” View

Human System Development

20 Years

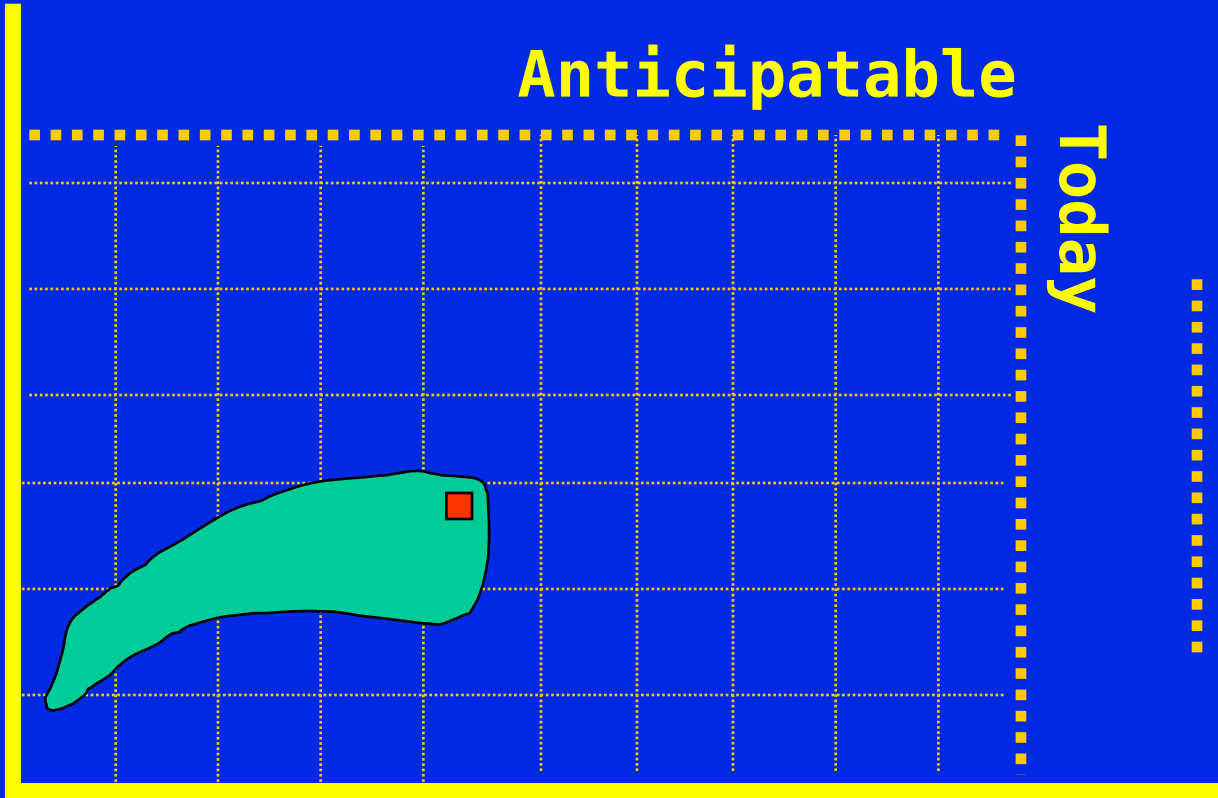
.....

Anticipatable

Today

20 Years

.....

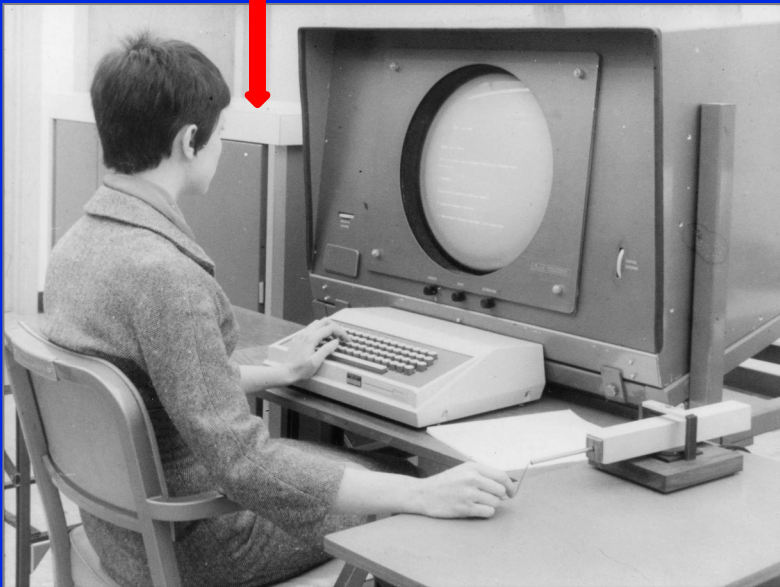


Tool System Utilization

2

Case Example from Our Lab

Cabinet



1964 Display Workstation

1967 Meeting Room



Rate and Scale of Change -- More thoughts about it:

- **Nanotechnology -- inevitable; for instance, what you'll be able to hold in your hand**
 - in the way of speed and storage
 - as much as now exists in the whole of ...?
- **How about surgically implanted personal computers?**
- **Large teams of intelligent agents which you utilize with practiced skill ...**

Co-Evolution Frontier: Probable View

Human System Development



3

20 Years

Outposts on the Co-Evolution Frontier

Human System Development

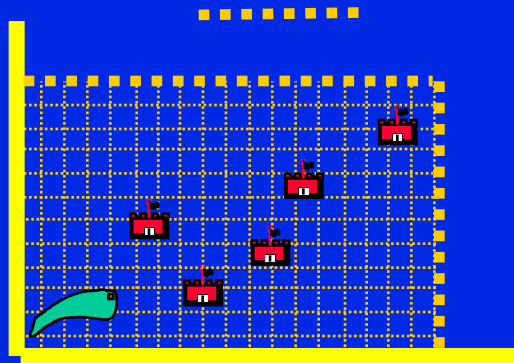


Going After the Opportunities

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Bootstrapping

**Co-Evolution
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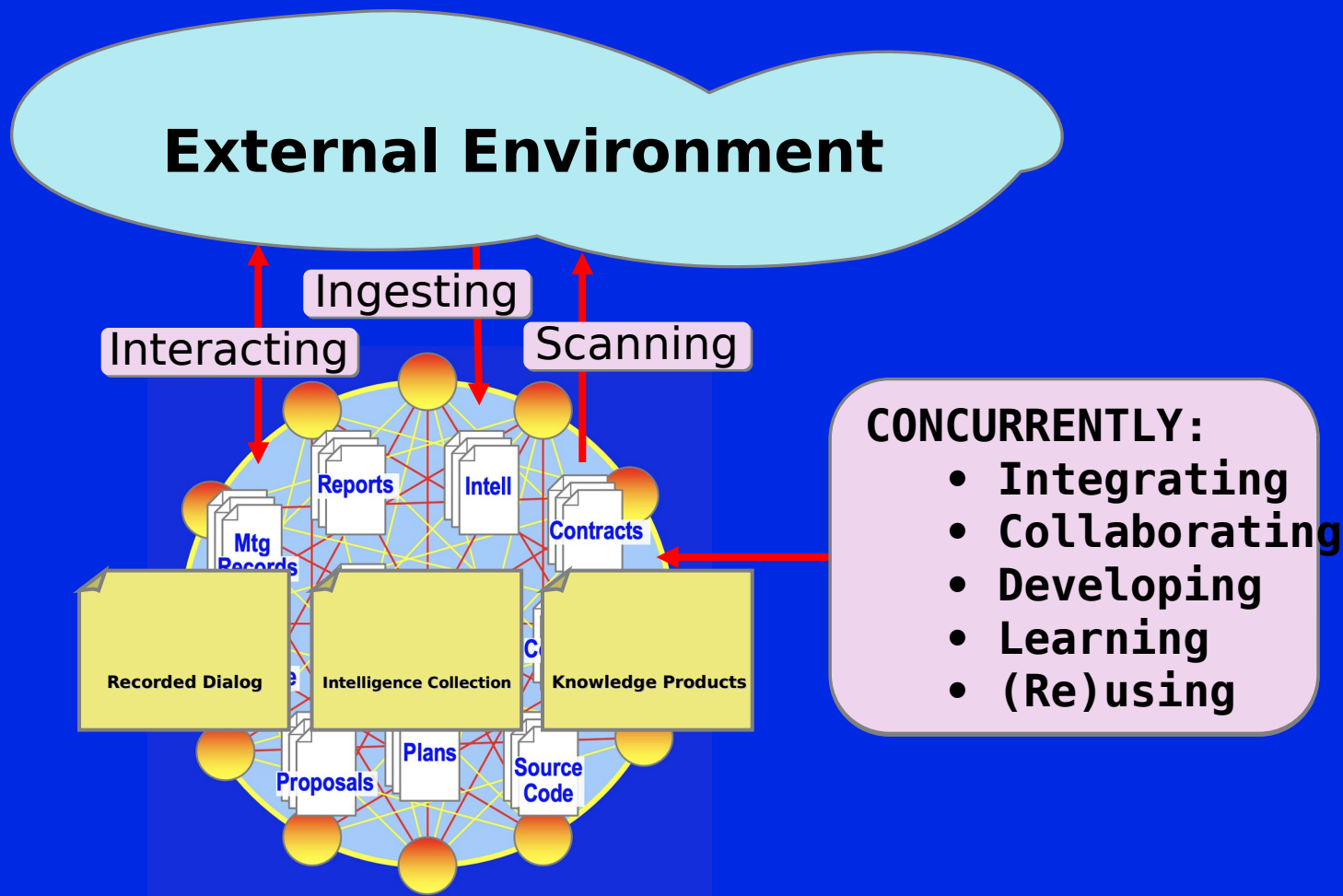
**Co-Evolution
Frontier**

People Working Together

... depend on
collective knowledge



Collective Intelligence in Action



Core Capabilities for Collective Intelligence

“CoDIAK”

Concurrent
Development
Integration and
Application of
Knowledge

Well beyond the current publish/consume paradigm

Requirements for OHS -- an Open Hyperdocument System

- To facilitate collaboration, coordination, and collective action (“real work”)
- To capture, integrate, and manage the emerging heterogeneous knowledge
- To enhance access, maneuverability, and (re)utilization
- Scalable, interoperable across domains

OHS - the critical missing piece

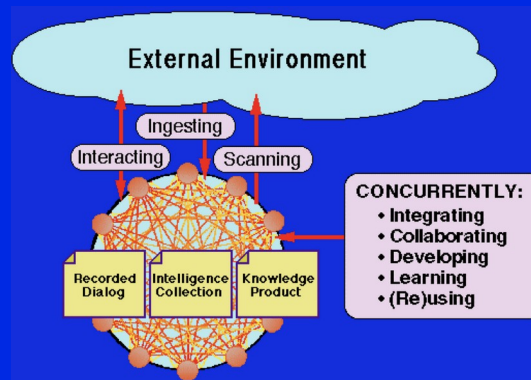
Reference <http://www.bootstrap.org/ohs>

Going After the Opportunities

ABCs of Improvement

Improvement Communities

Collective Intelligence



Bootstrapping

Co-Evolution Frontier

Going After the Opportunities

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Improvement**

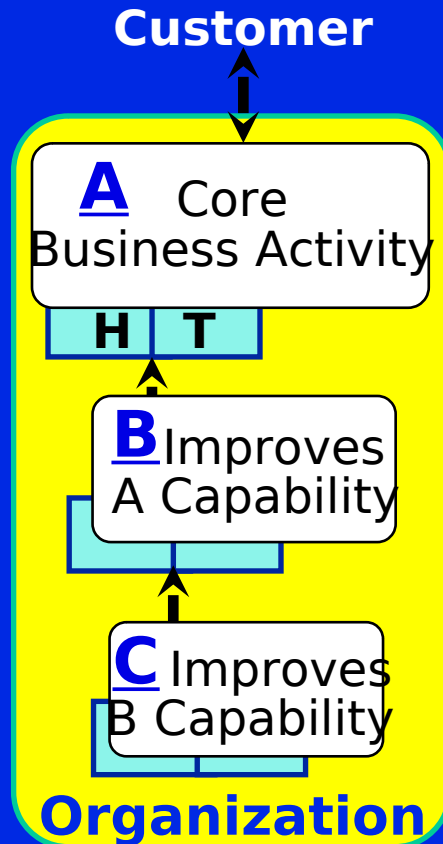
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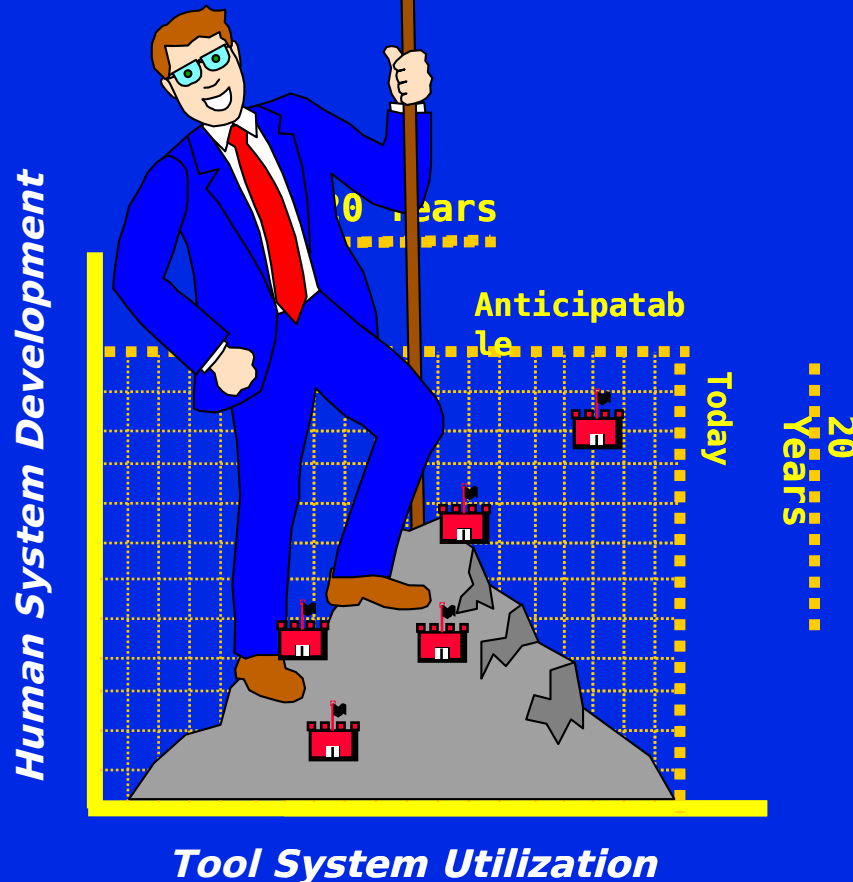
**Co-Evolution
Frontier**

Readying the Organization for Frontier Penetration



- A Activity - serves the customer
- B Activity - improves *product cycle* time and quality
- C Activity - improves *improvement cycle* time and quality

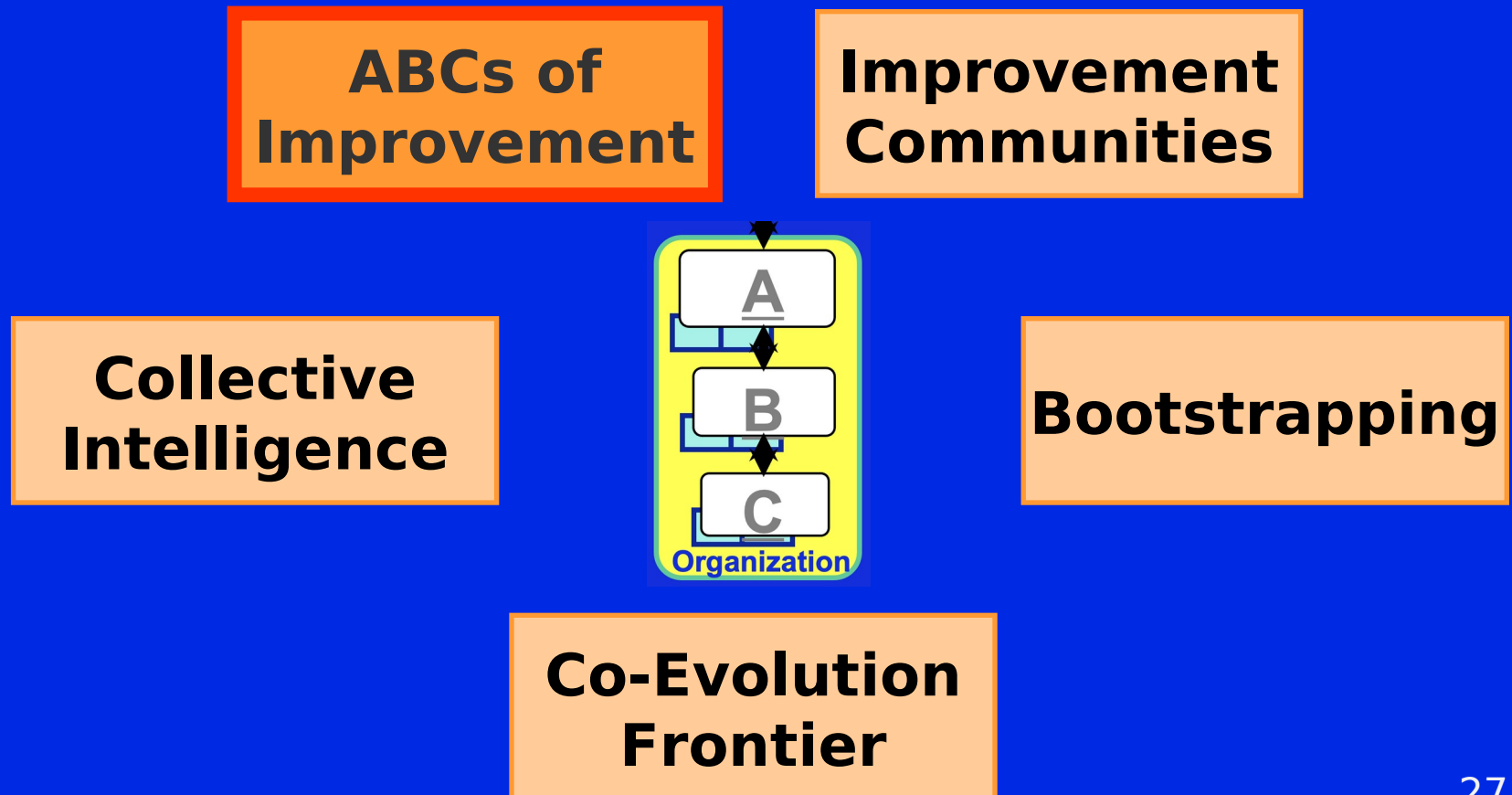
ABCs of the Organization's Frontier Penetration



- **Cs Scout** -- *what's out there (opportunities, threats, ...), mapping strategic directions, learning how to move in this space, coaching the Bs, ...*
- **Bs Move 'em Out** -- *picking the path, moving the organization*

Improving faster, better, cheaper, more ...

Going After the Opportunities



Going After the Opportunities

**ABCs of
Improvement**

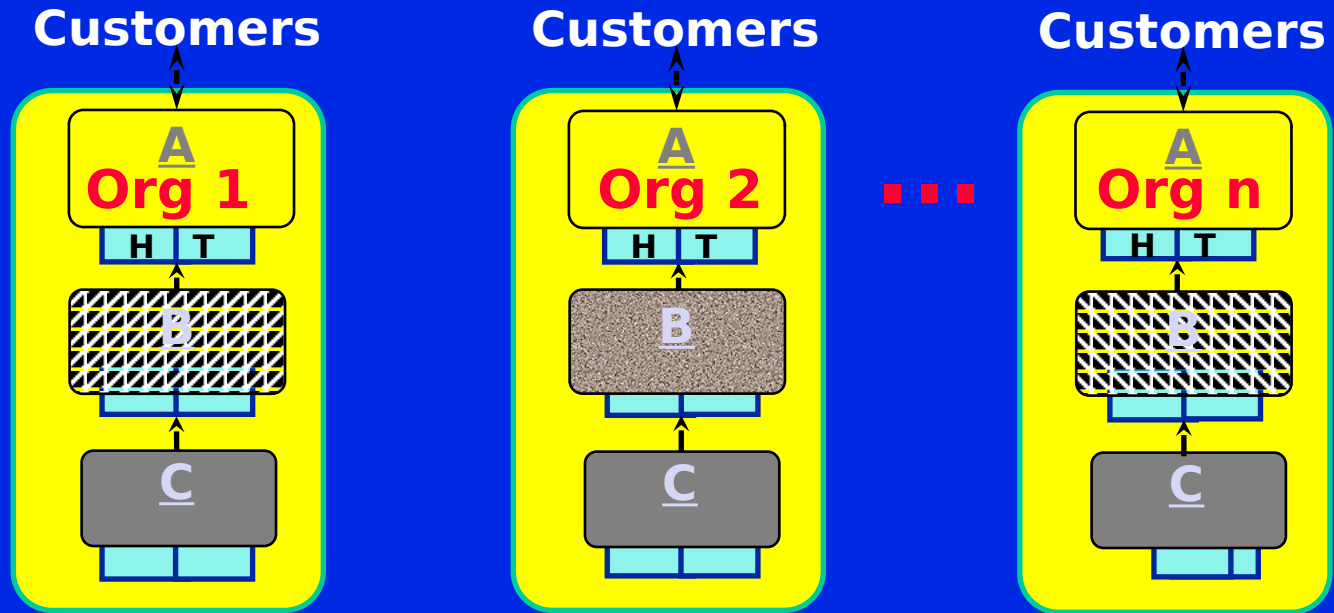
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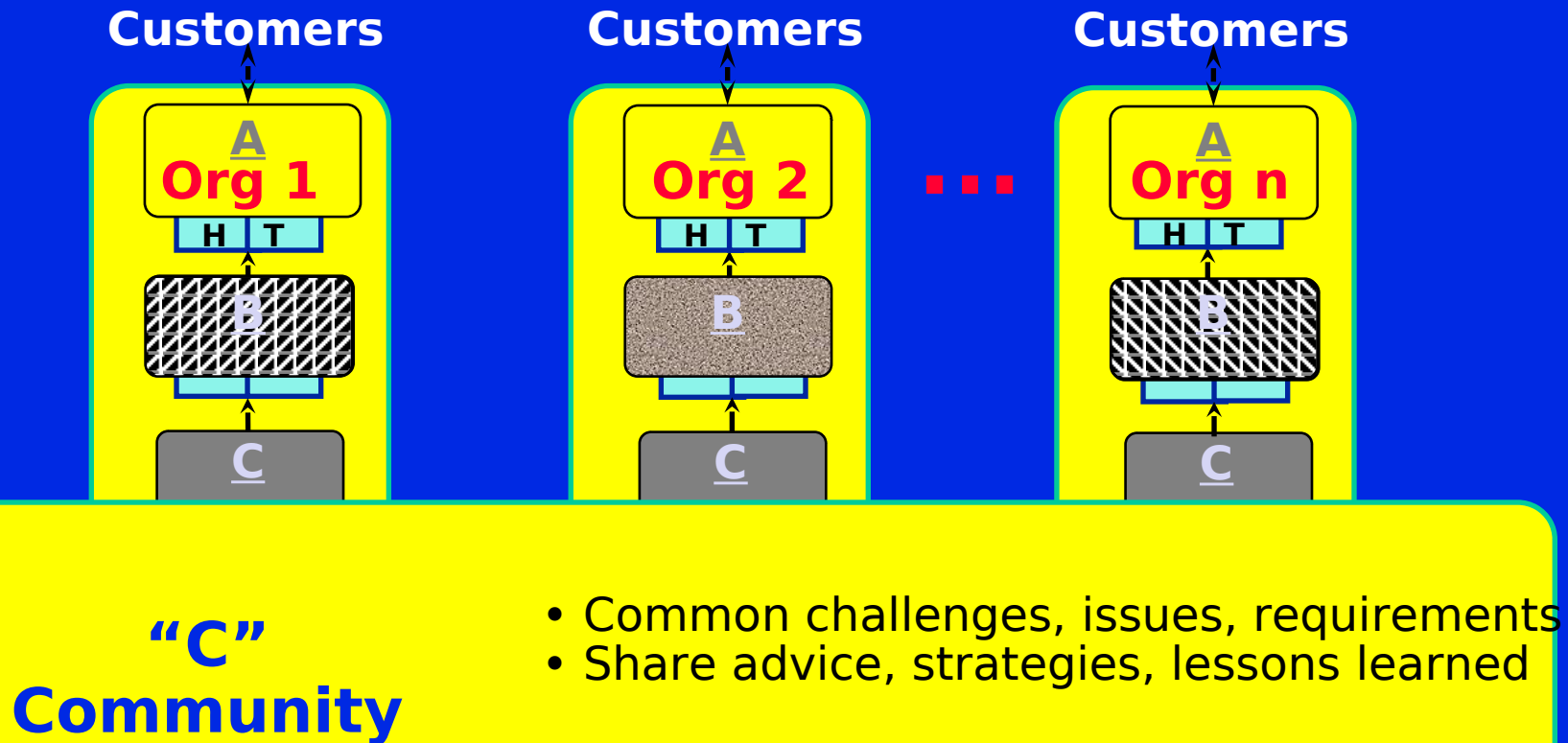
**Co-Evolution
Frontier**

Look for Other Organizations on the Frontier Heading the Same Way . . .



. . . i.e. improving a similar set of capabilities

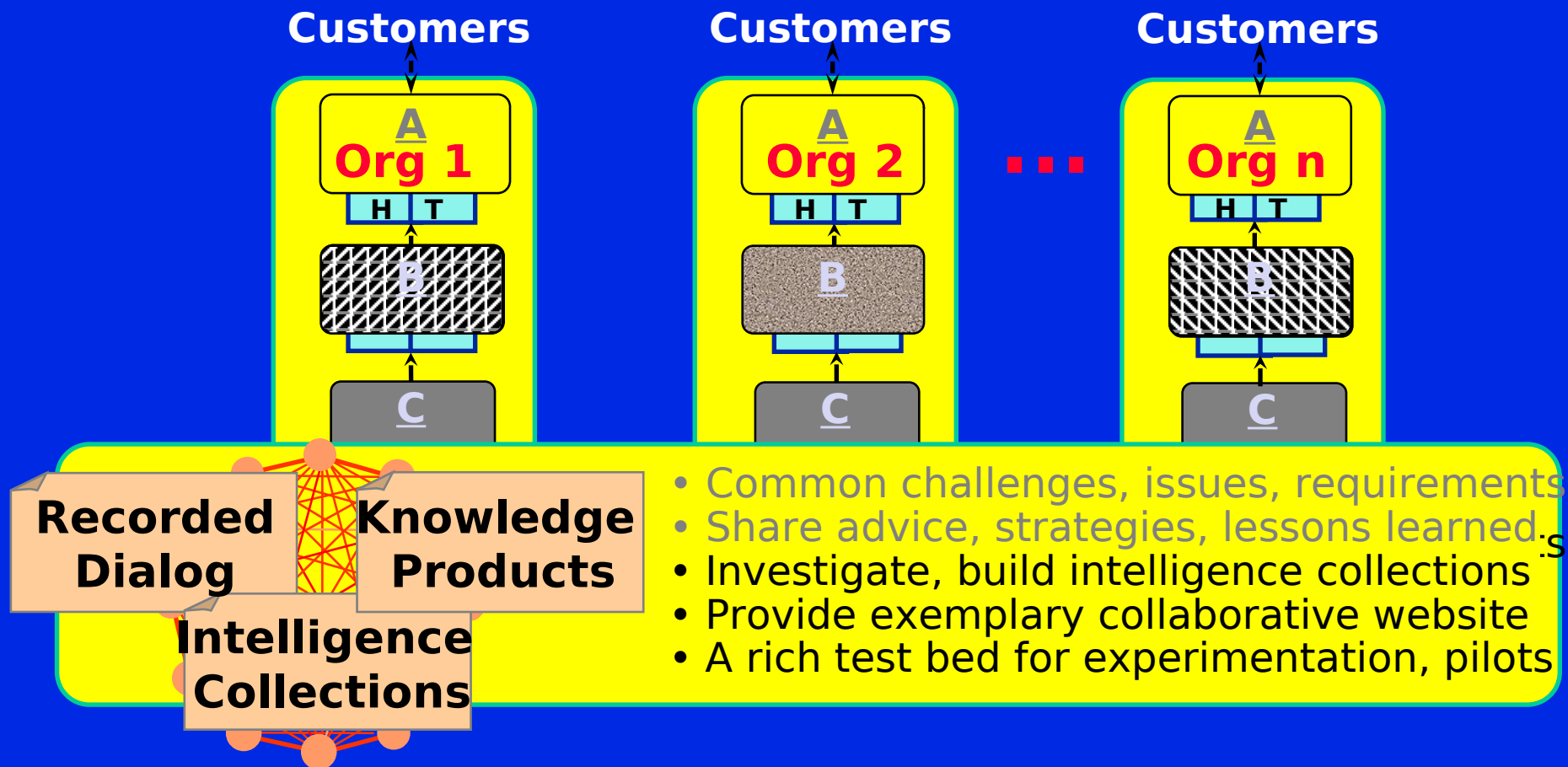
Join Forces in an Improvement Community



Each "C" member actively serves his/her respective B initiatives

Networked Improvement Community ("NIC")

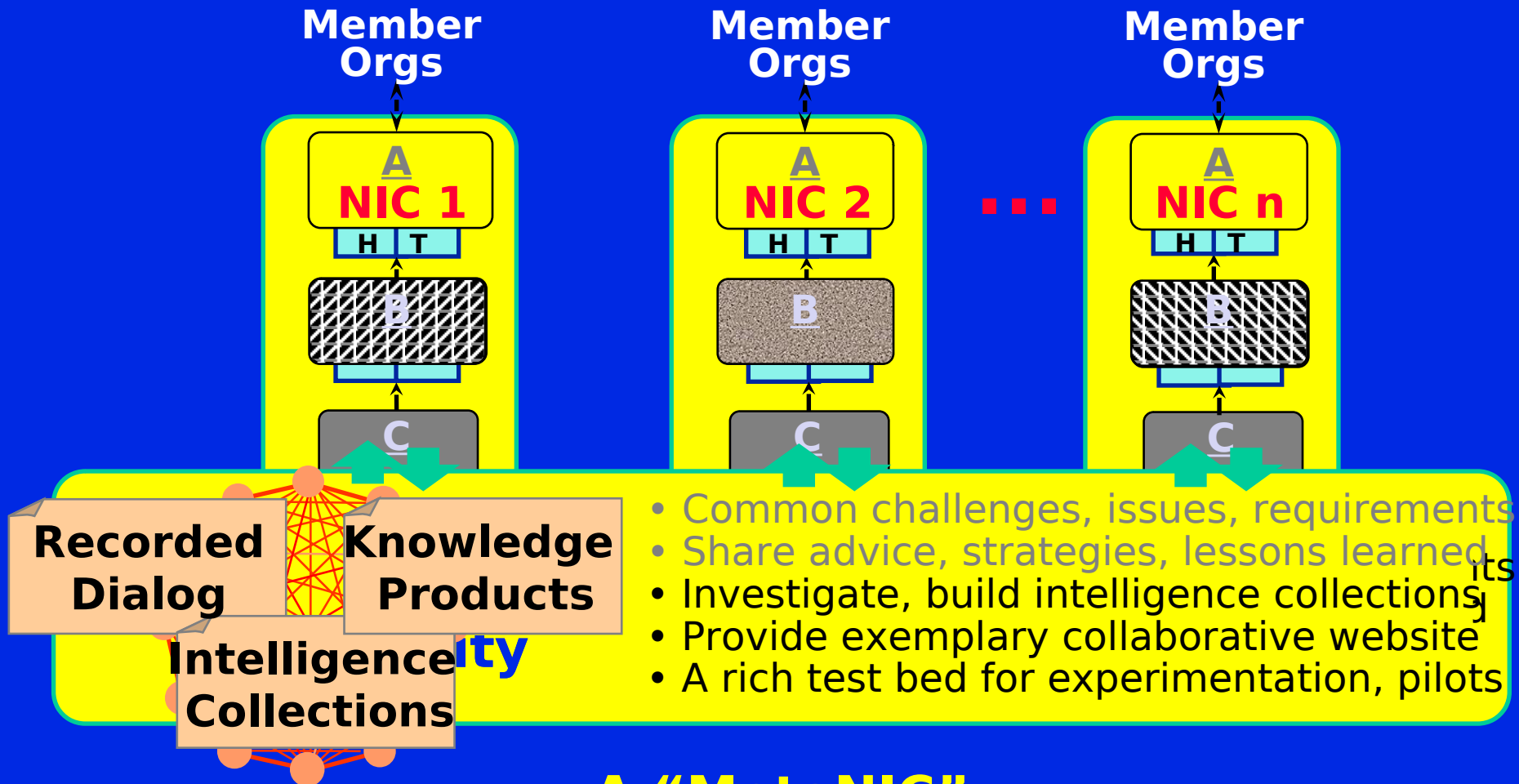
Sharing risk, cost, knowledge, experience



*Actively Pushing its Collective IQ Envelope*³¹

The Bootstrap Alliance - a “MetaNIC”

NICs collectively improving their NIC capabilities



A “MetaNIC”

Going After the Opportunities

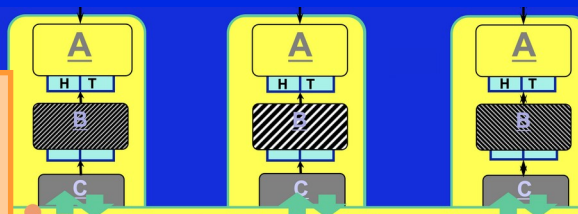
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Knowledge Products

- Common challenges, issues, requirements
- Share advice, strategies, lessons learned
- Investigate, build intelligence collections
- Provide exemplary collaborative website
- A rich test bed for experimentation, pilots

Intelligence Collections

Going After the Opportunities

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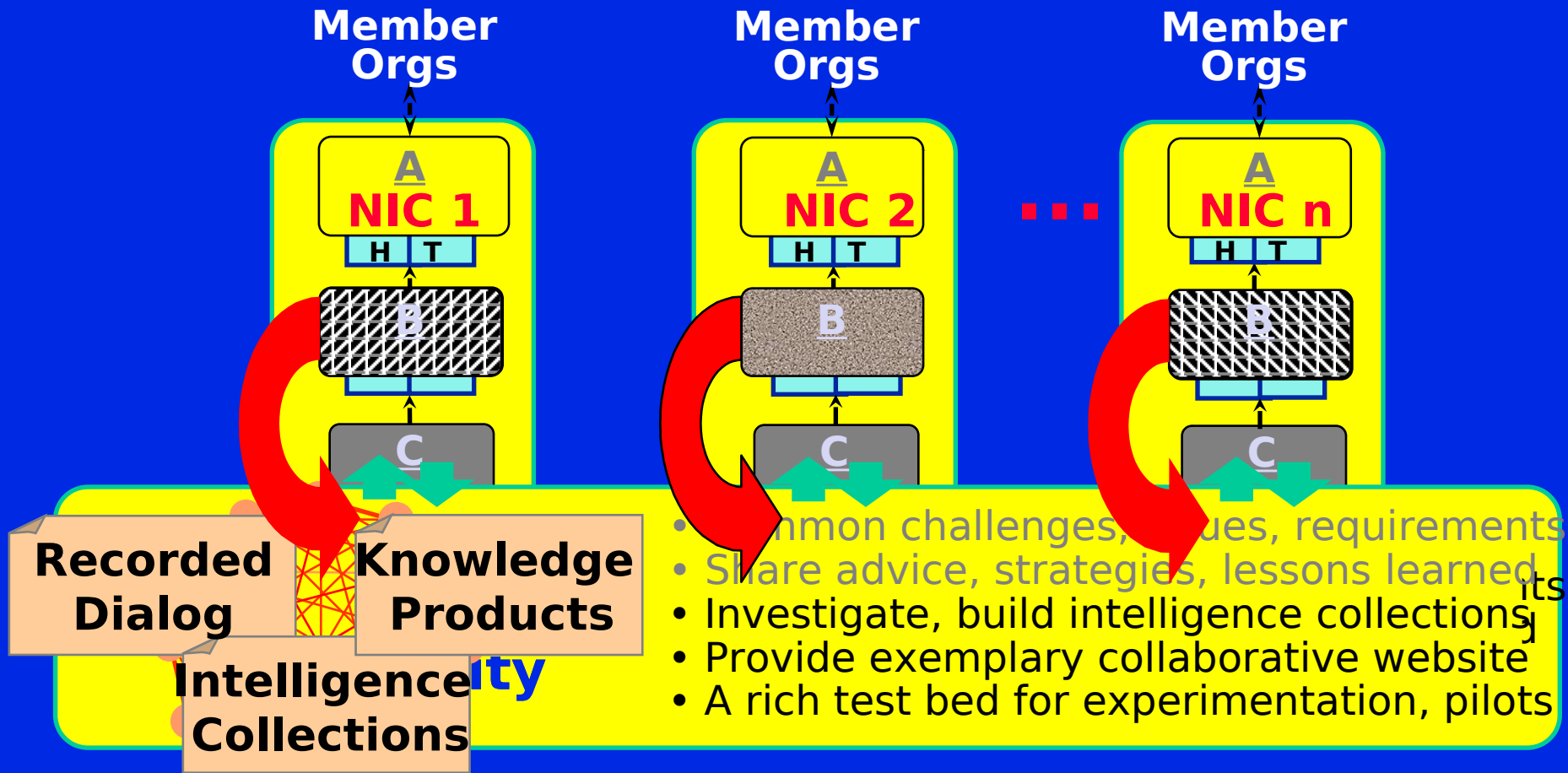
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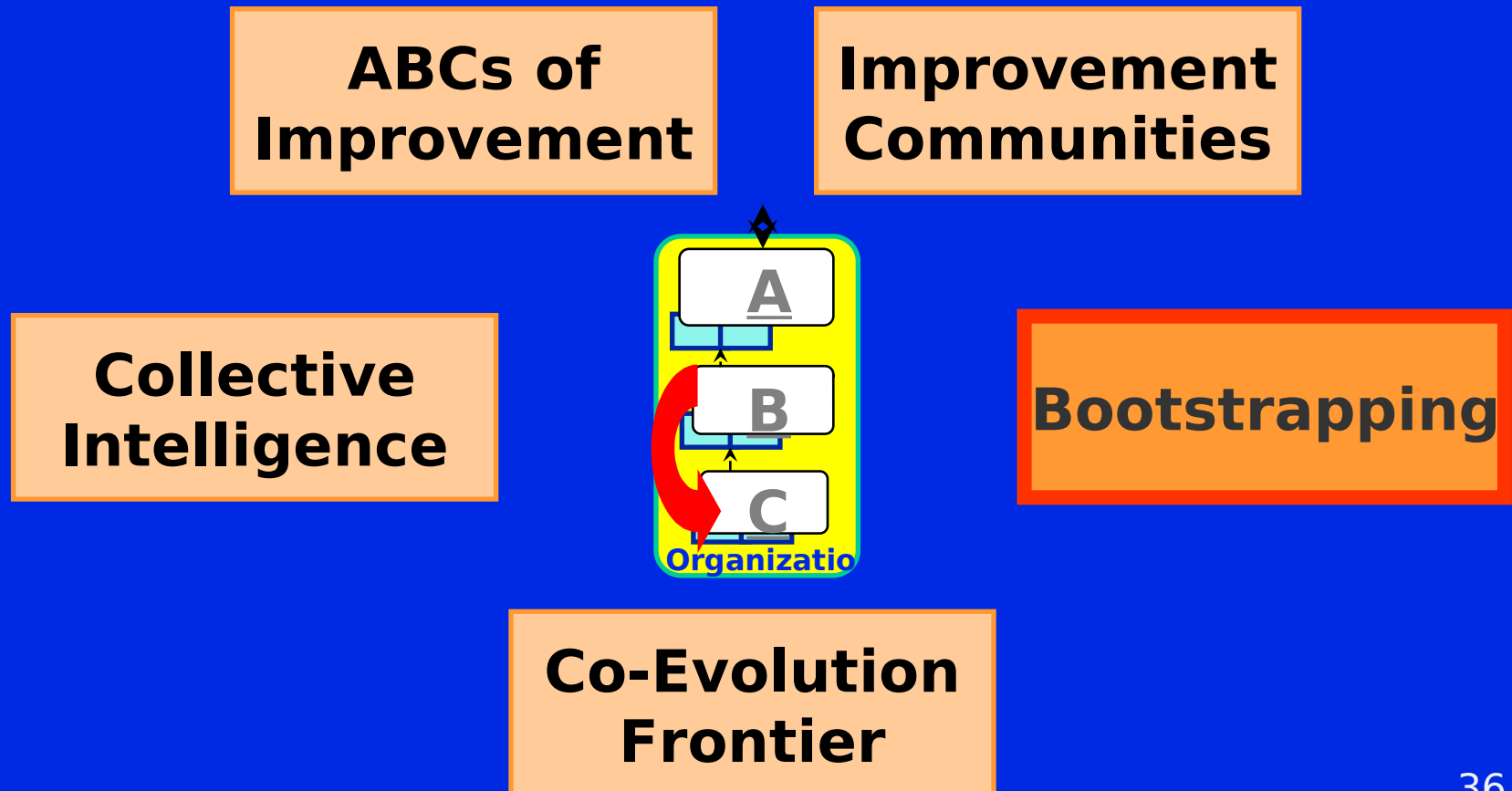
**Co-Evolution
Frontier**

Look for High “Bootstrapping Index”*



** I.e. whose B output offers leverage to the C Community*

Going After the Opportunities



Bootstrap Alliance, U.S.

Current Participants

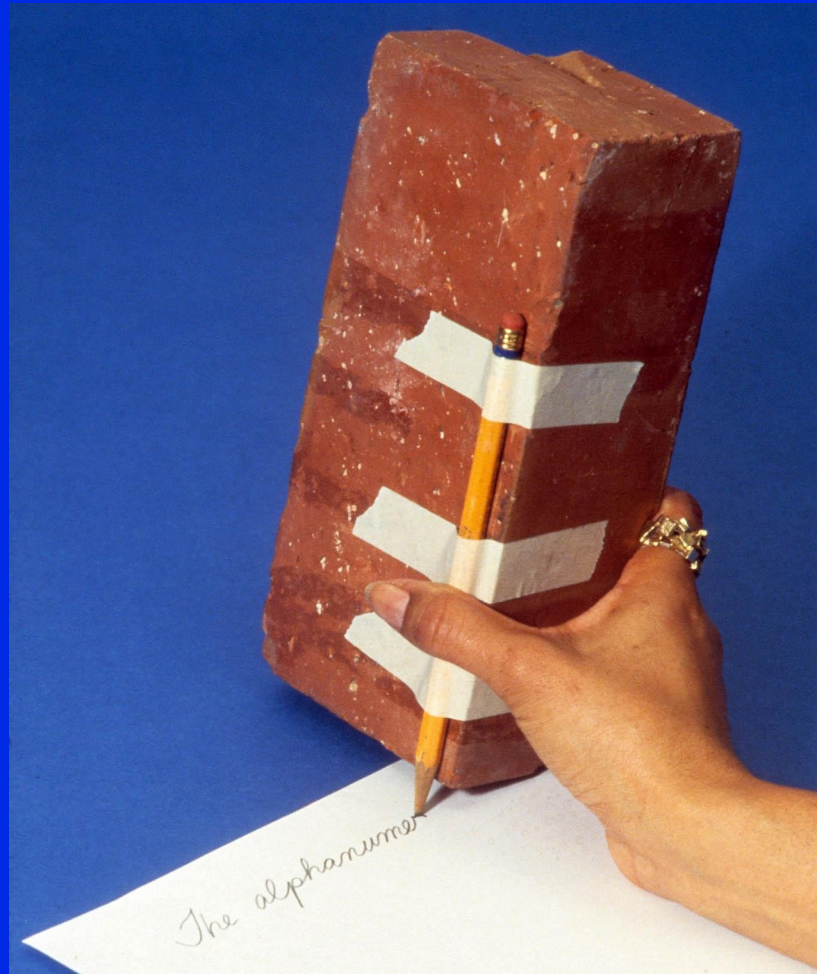
(partial list)

- **Sun Microsystems**
- **Educational Testing Service**
- **NTT Multimedia Laboratory**
- **Fuji Xerox**
- **US General Services Administration**
- **US National Security Agency**
- **Santa Clara Univ. (CSTS)**
- **Stanford Univ. (CSLI, SLL)**
- **Development Alternatives, Inc.**
- **ACM SIG Web, SIG CHI**
- **National School Boards Association**
- **Rush Medical Center**
- **Institute for the Future**
- **SRI International**
- **Morino Institute**
- **National Science Foundation**

Open-Source Pursuit of CoDIAK and OHS

- **Need participatory communities actively involved with using and improving both CoDIAK and OHS.**
- **Need initial framework for the hyperdocument architecture.**
- **Need initial framework for the functional tool systems.**
- **Need basic organizational framework for coordination and governance.**

What if this was what we used to manipulate symbols?

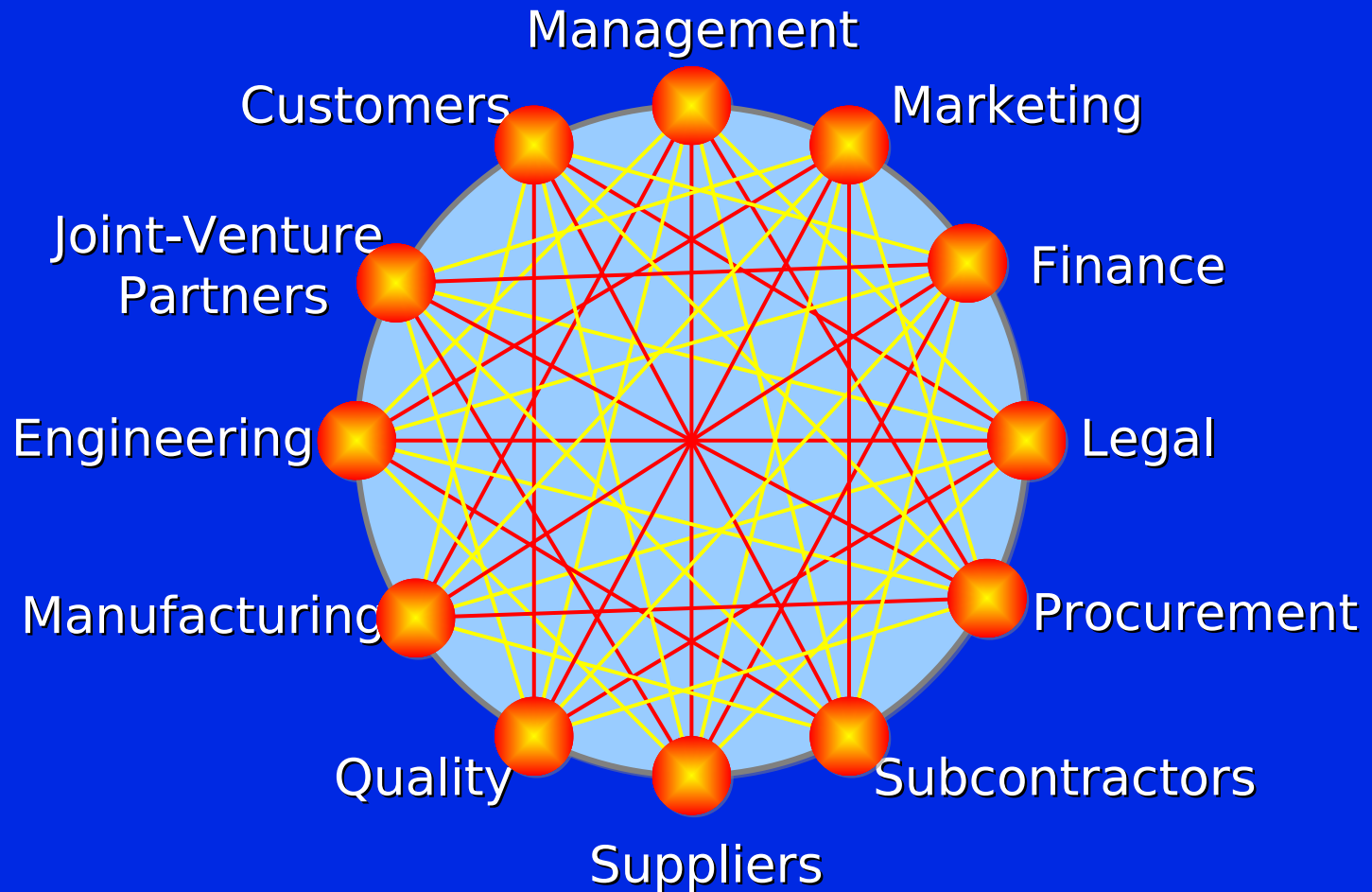


“Easy to Learn” Paradigm vs. High Performance Teams



Sample Organization

*Knowledge islands limit coordination - what's needed:
open hyperdocument interoperability across the working
knowledge*



Sample Aircraft Program

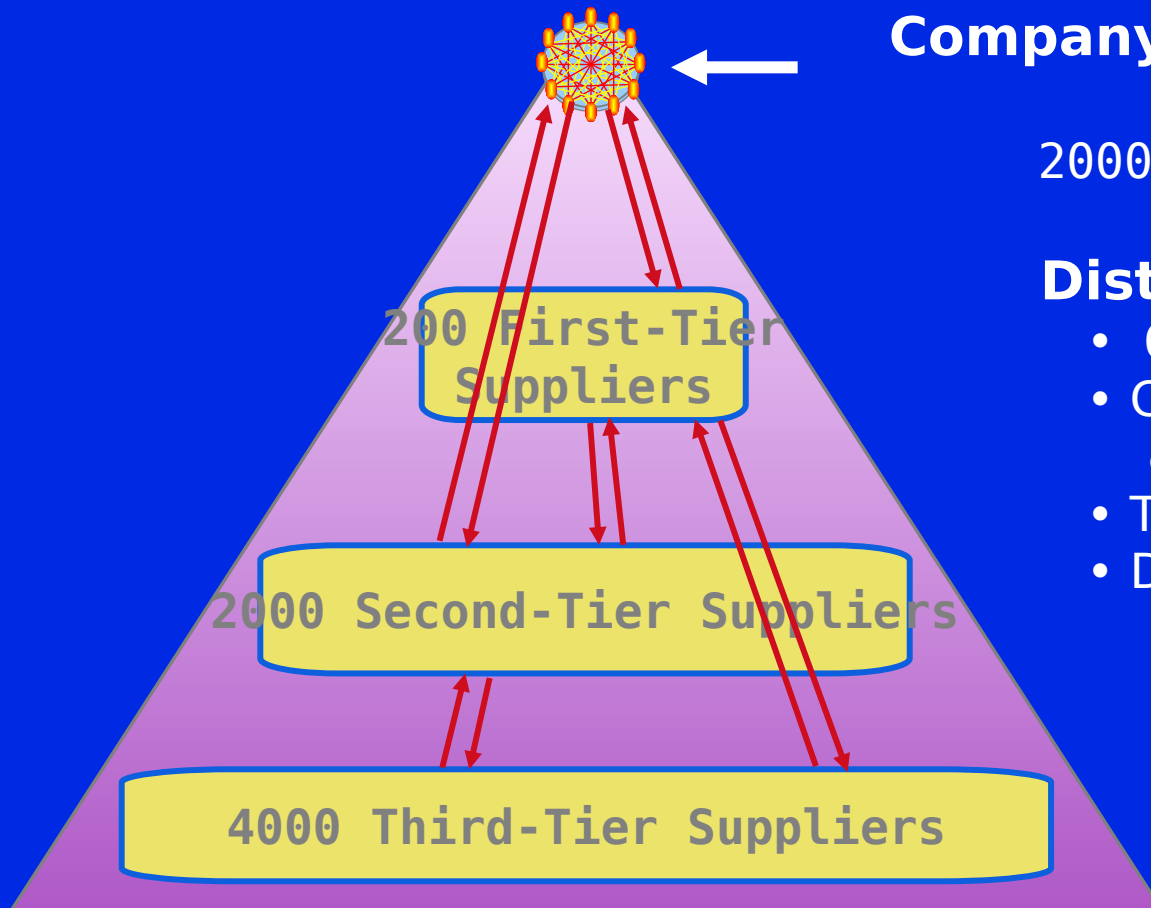
Knowledge islands in a supplier hierarchy of a major aircraft program would be very costly

Company X - Major Aircraft Program

2000 - 3000 people

Distributed Nationwide

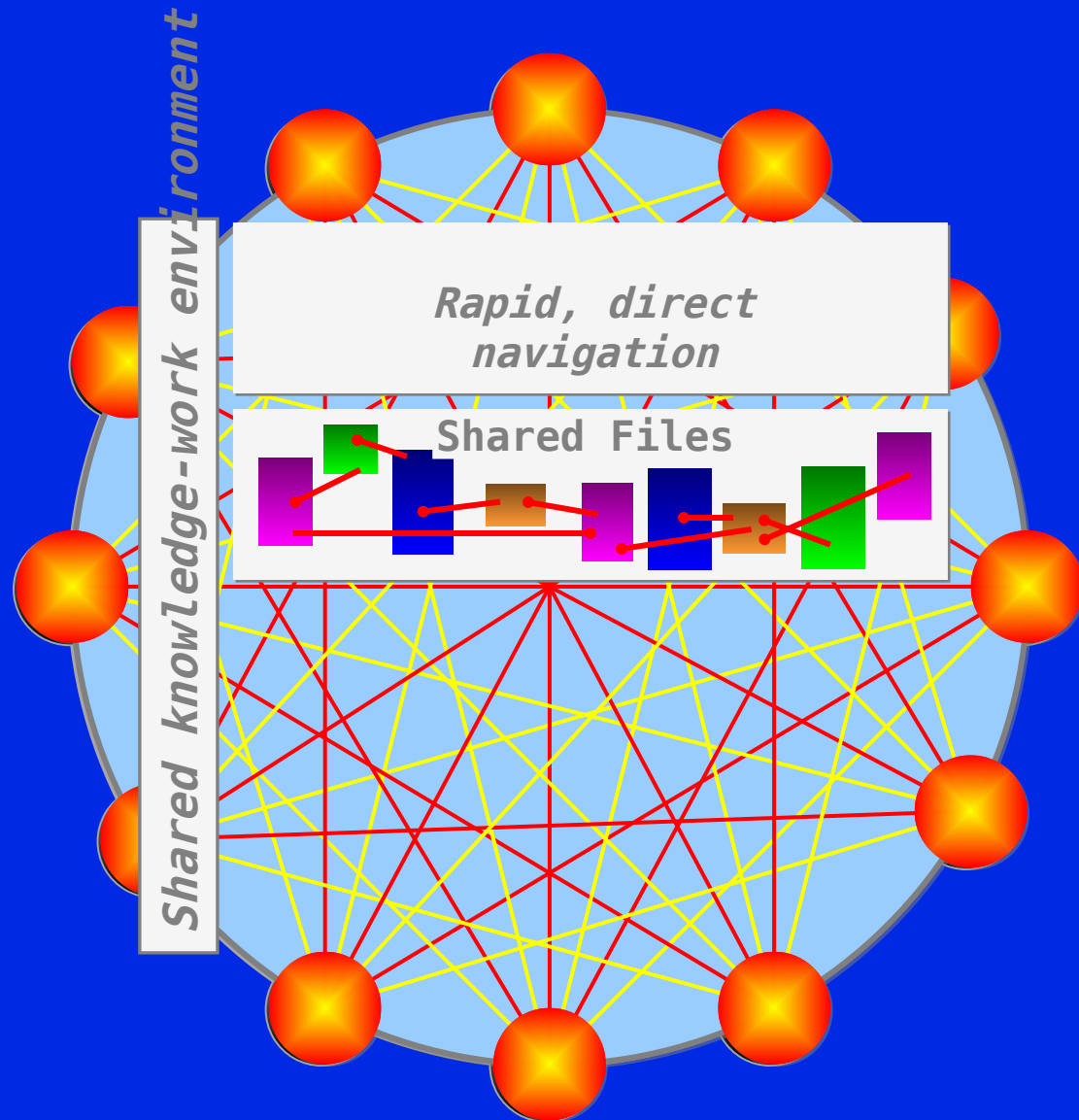
- 6000+ companies
- Collaborating on tasks & specifications
- Tracking progress
- Developing products



OHS to Support Basic CoDIAK Work

- Structured
- Object linking
- Viewing
- Browsing
- Shared Screens
- Scripting

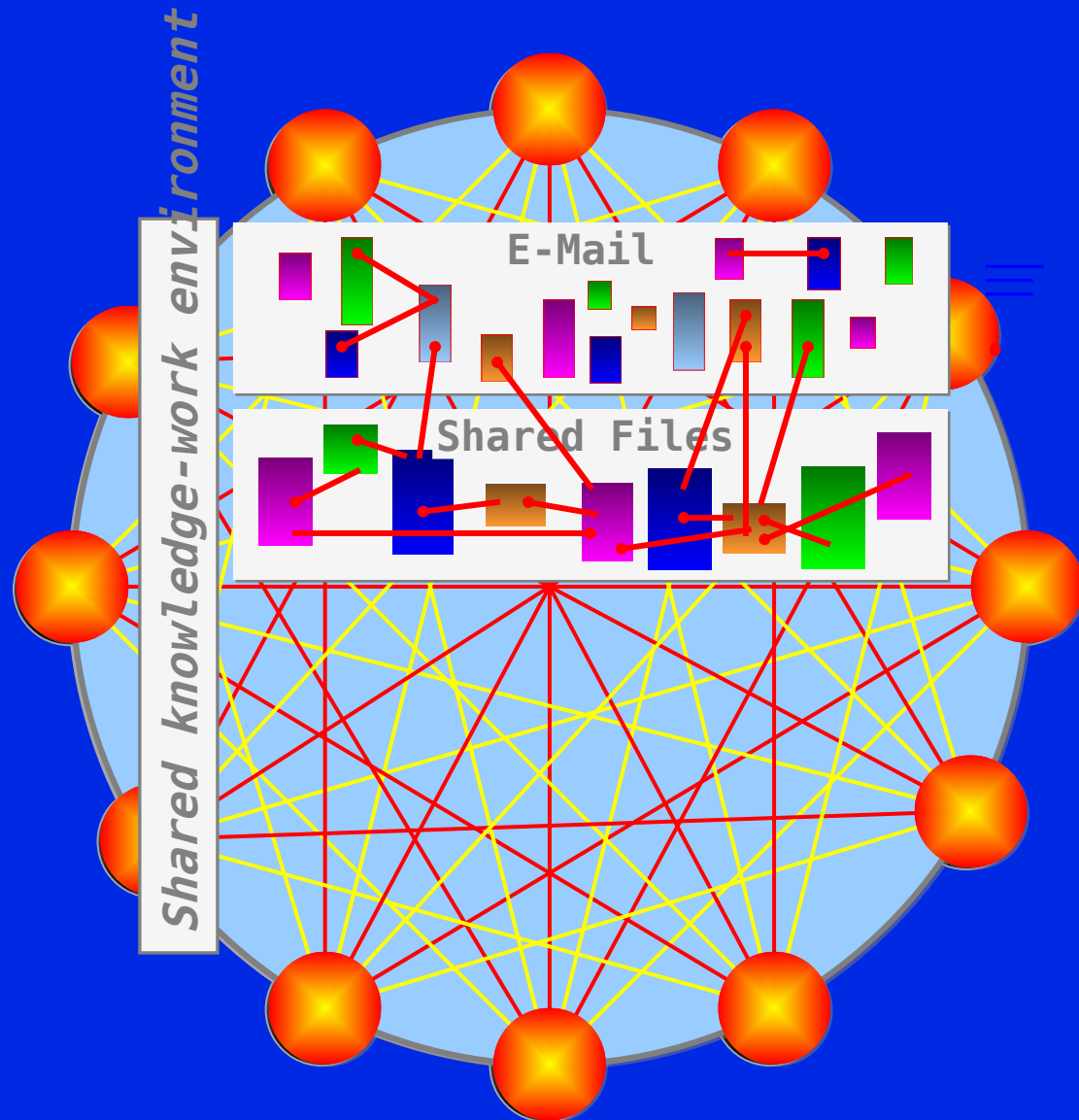
CoDIAK
Example



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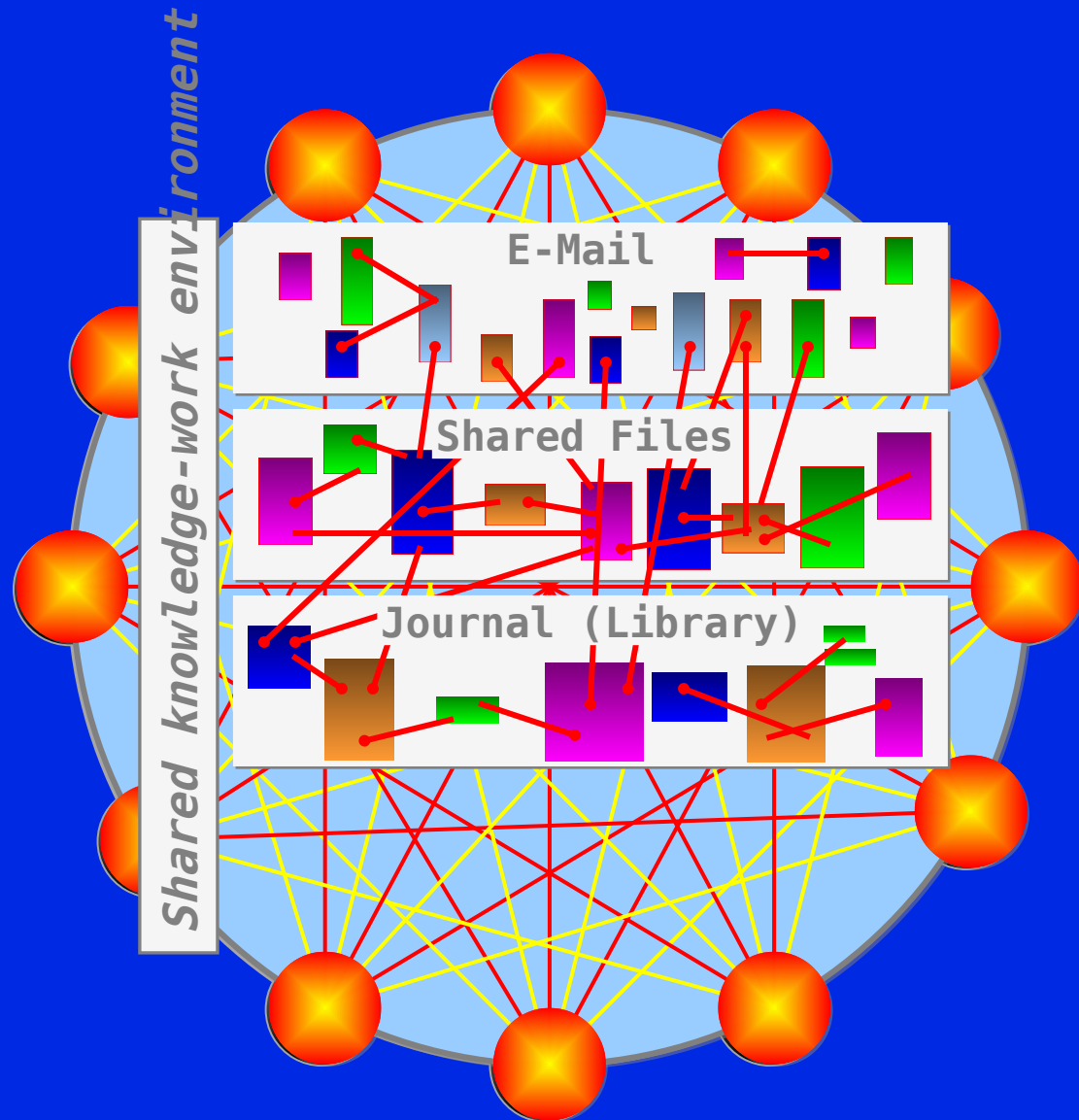
CoDIAK
Example



OHS to Support Basic CoDIAK Work

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CoDIAK
Example



Online Email Management

File
Edit
View
Fields
Email Documents
Mail Draft
To: terry.org
Cc: lane.org
Subject: Project Status
Message: Attach <Doc X>

Access
Addendum-to
Assign
Classification
Comment
Disposition
Extended-to
Journal
Keyword
References-to
Part-of
Sign
Supersedes

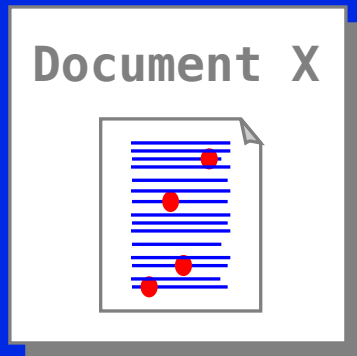
Email Notices

terry.org

Email
Inbox
To: terry.org
Cc: lane.org
Subject: Project Status
Journal: XYZ
Message: See <Doc X>

lane.org

Email
Inbox
To: terry.org
Cc: lane.org
Subject: Project Status
Journal: XYZ
Message: See <Doc X>



Journal (Library)

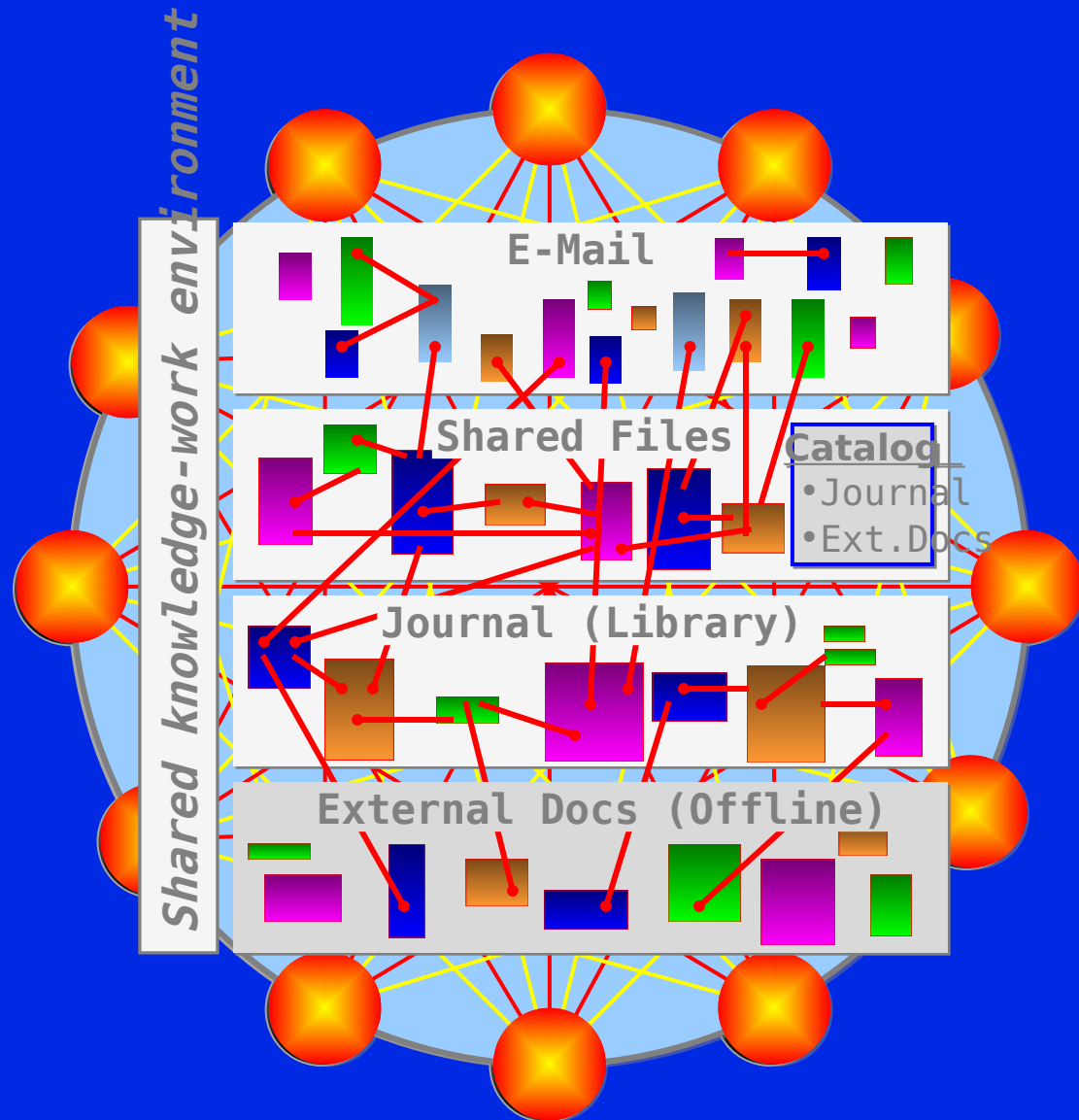
DEMO

Example:
Posting a document in the Journal

OHS to Support Basic CoDIAK Work

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CoDIAK Example



OHS to Support Basic CoDIAK Work

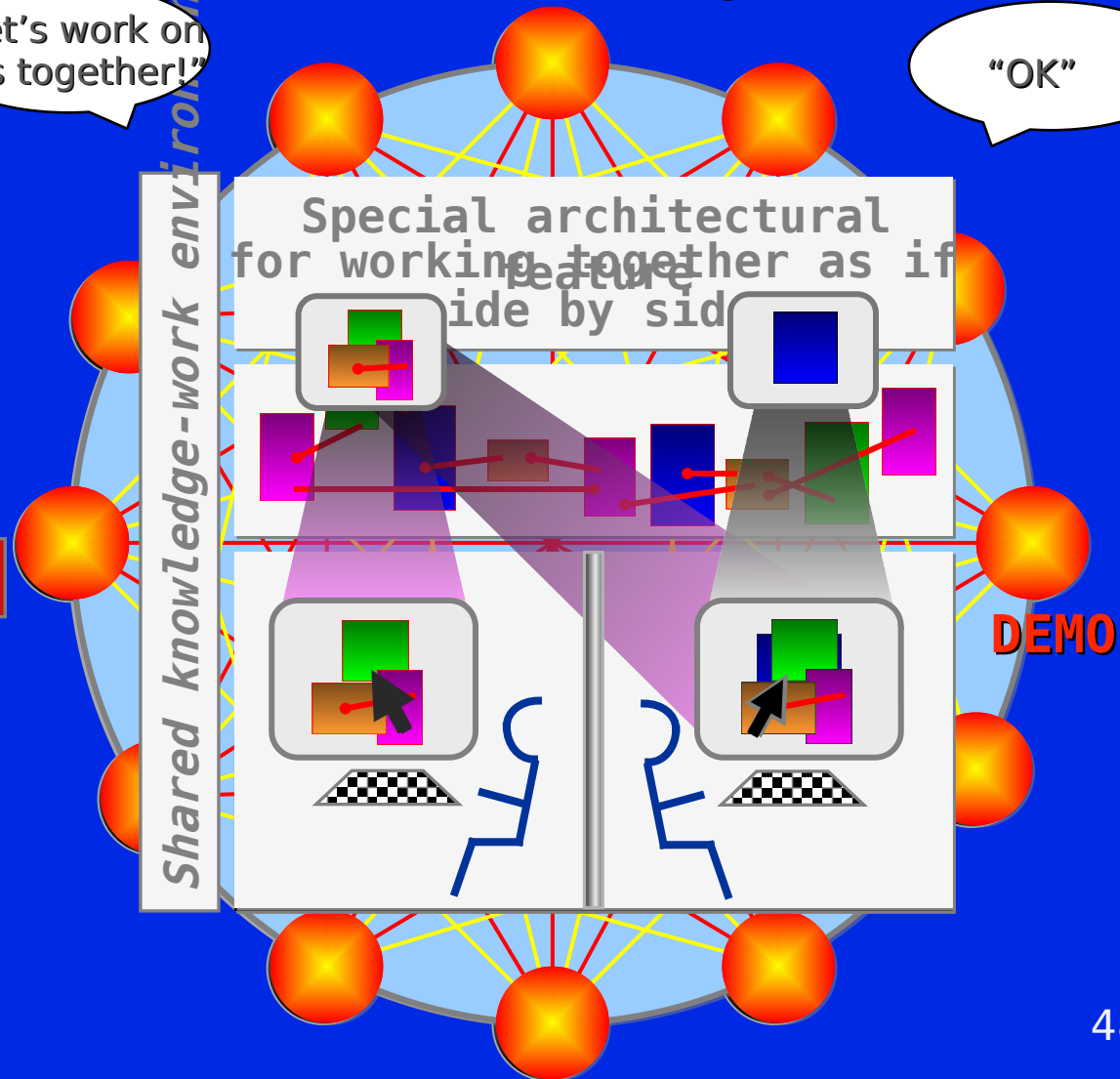
Taking turns as the “designated driver”

“Let’s work on this together!”

“OK”

- Structured
- Object linking
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CoDIAK
Example



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About High-Performance Teams

- **Explicitly recruited, equipped and trained, as though for competitive performance assessments.**
- **No limit to the unusual ways in which their fundamental sensory, perceptual, cognitive, motor capabilities are trained, conditioned and harnessed.**
- **Strategically, seems best at first to be engaged as SUPPORT TEAMS -- providing special services to larger teams operating in “current mode.”**

A Key Utilization for High Performance Support Teams

- **Support a larger, “conventionally capable” community, organization, or project team.**
- **Facilitate the CoDIAK processes associated with developing and maintaining its Dynamic Knowledge Repository.**
- **Special strategic value if HPASTs focus on the CoDIAK “Integration” processes, toward making significant improvements in the effectiveness for “very heavy types of collective knowledge work.”**

Multi-Class UIS for Serious Frontier Penetration

- **The High-Performance Support Teams need to operate over the same Knowledge Repositories as their supported communities.**
- **“Pedestrian Users” use their level of UIS class, and are encouraged to gain knowledge and skill to move up to higher-level UIS classes.**
- **Richer properties provided in hyperdocument standards may remain invisible until a user graduates to appropriate higher level.**
- **Similar with application functionality.**

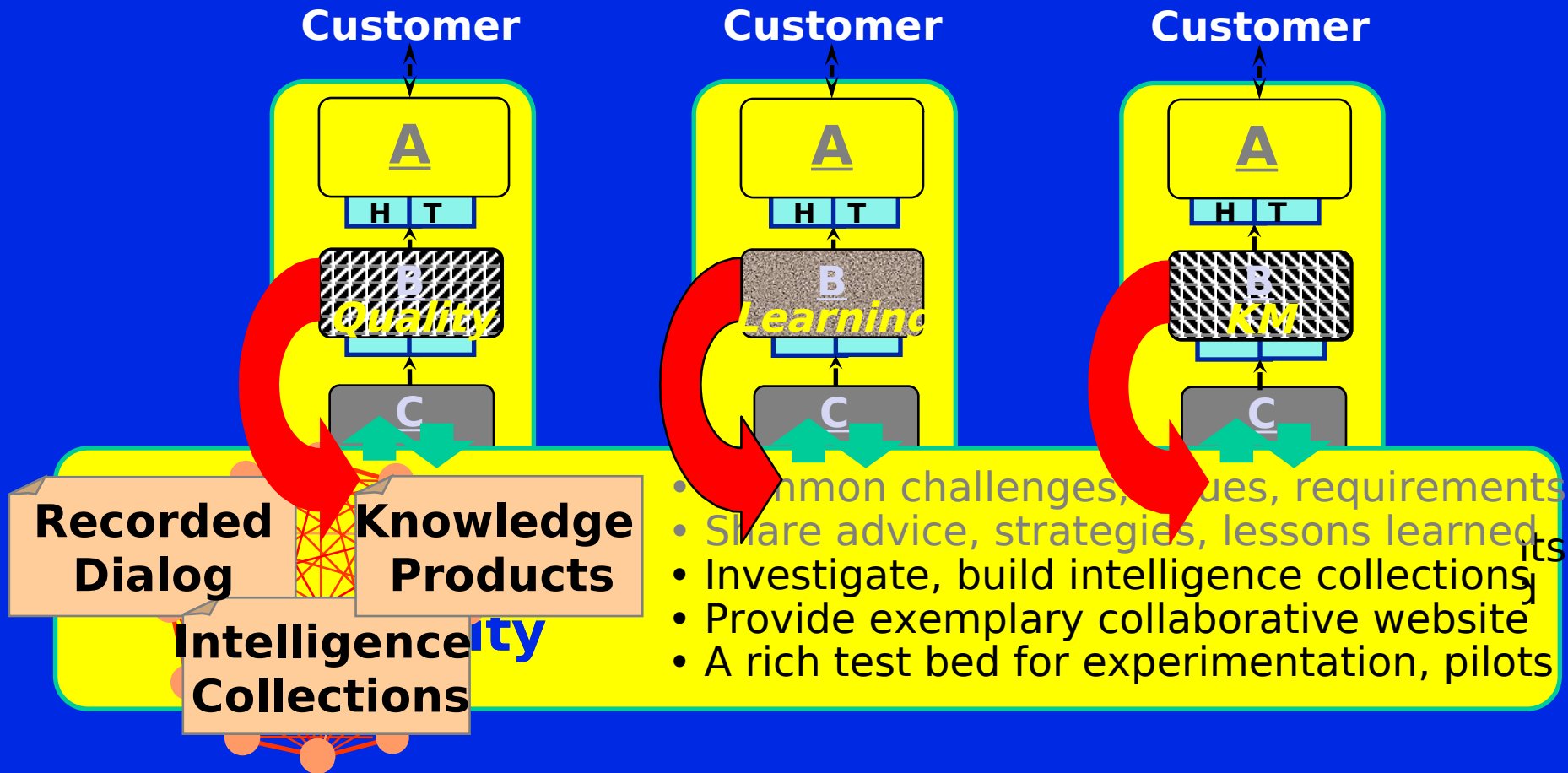
University HPSTs -- label it “High Performance Scholarship”

- **Keeping the core “Textbook / Handbook” for a given discipline updated. Totally. Monthly.**
- **Then weekly?**
- **Then Daily?**
- **These are for-real future possibilities.**
- **Who is going to help most to get there?**

Putting It All Together

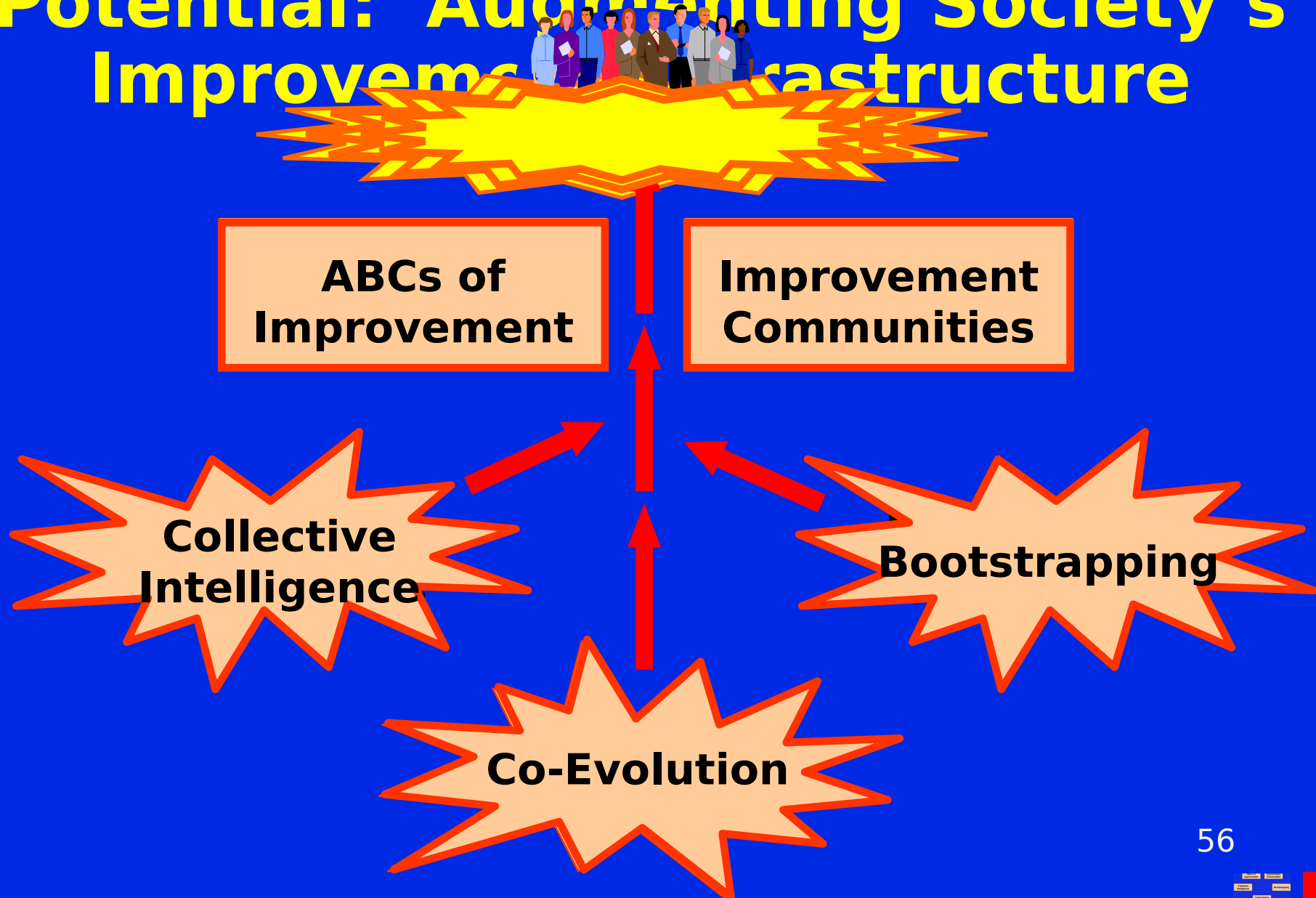


What more natural leader here than a NIC of selected ACM SIGs?



How about? CHI, GROUP, WEB, IR, ...?

Potential: Augmenting Society's Improvement Infrastructure



The End

For more information see
<http://www.bootstrap.org/>

REVIEW

Bootstrapping Our Collective Intelligence

**Study Aid - Summary slides assembled
for learner's convenience
after the lecture was presented.**

Exploding Rate and Scale of Change



Exploding Rate and Scale of Change

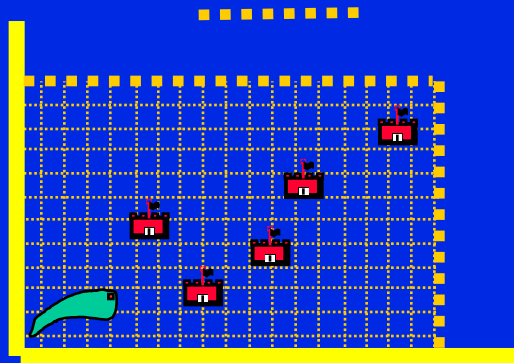
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Bootstrapping

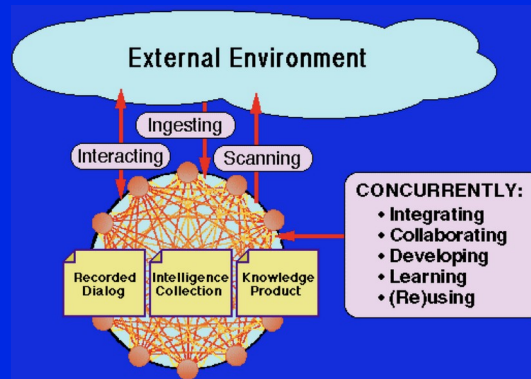
Co-Evolution Frontier

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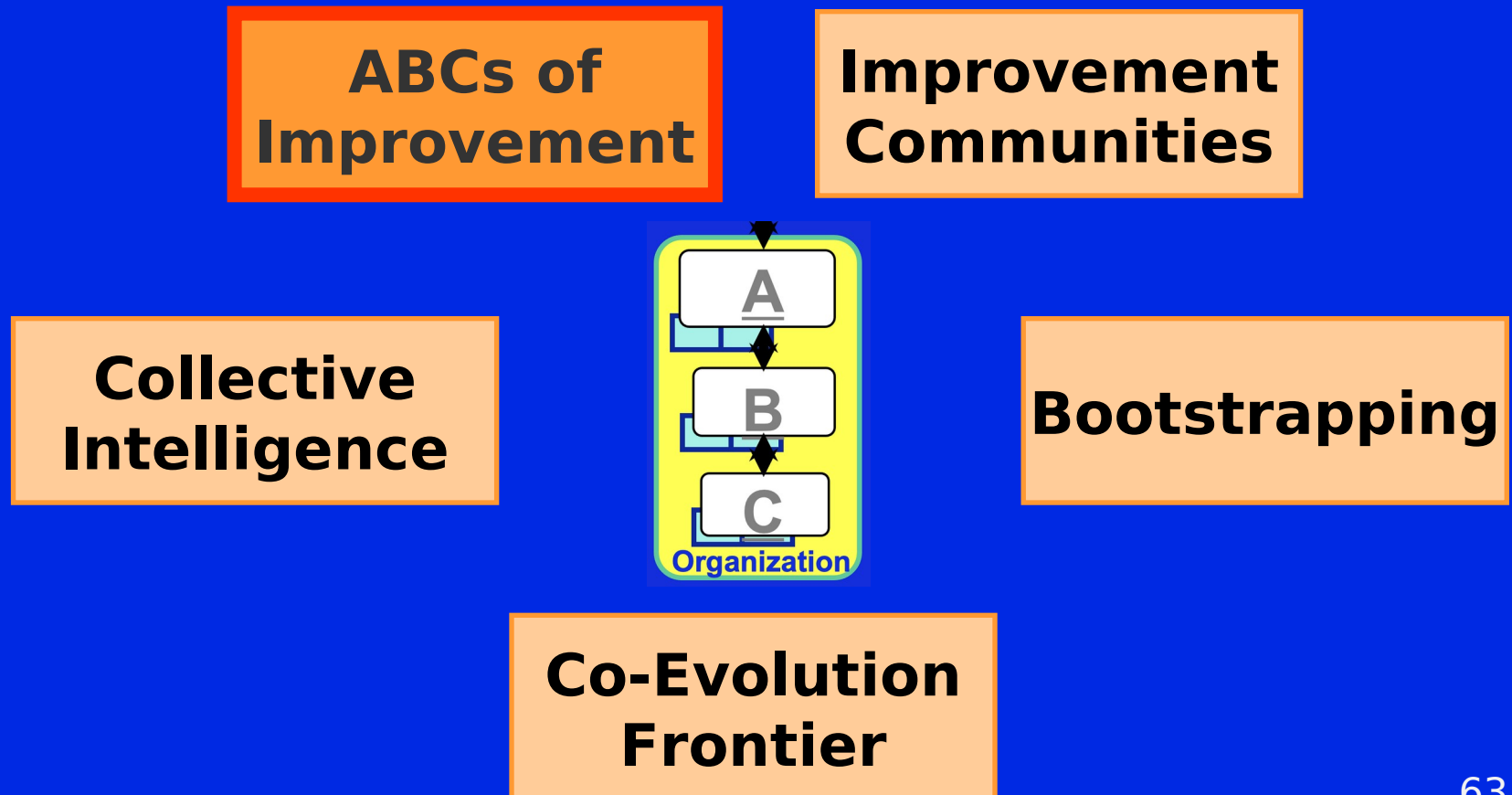
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Bootstrapping

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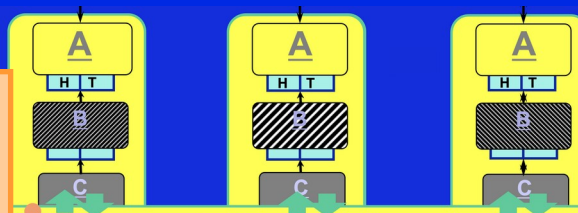
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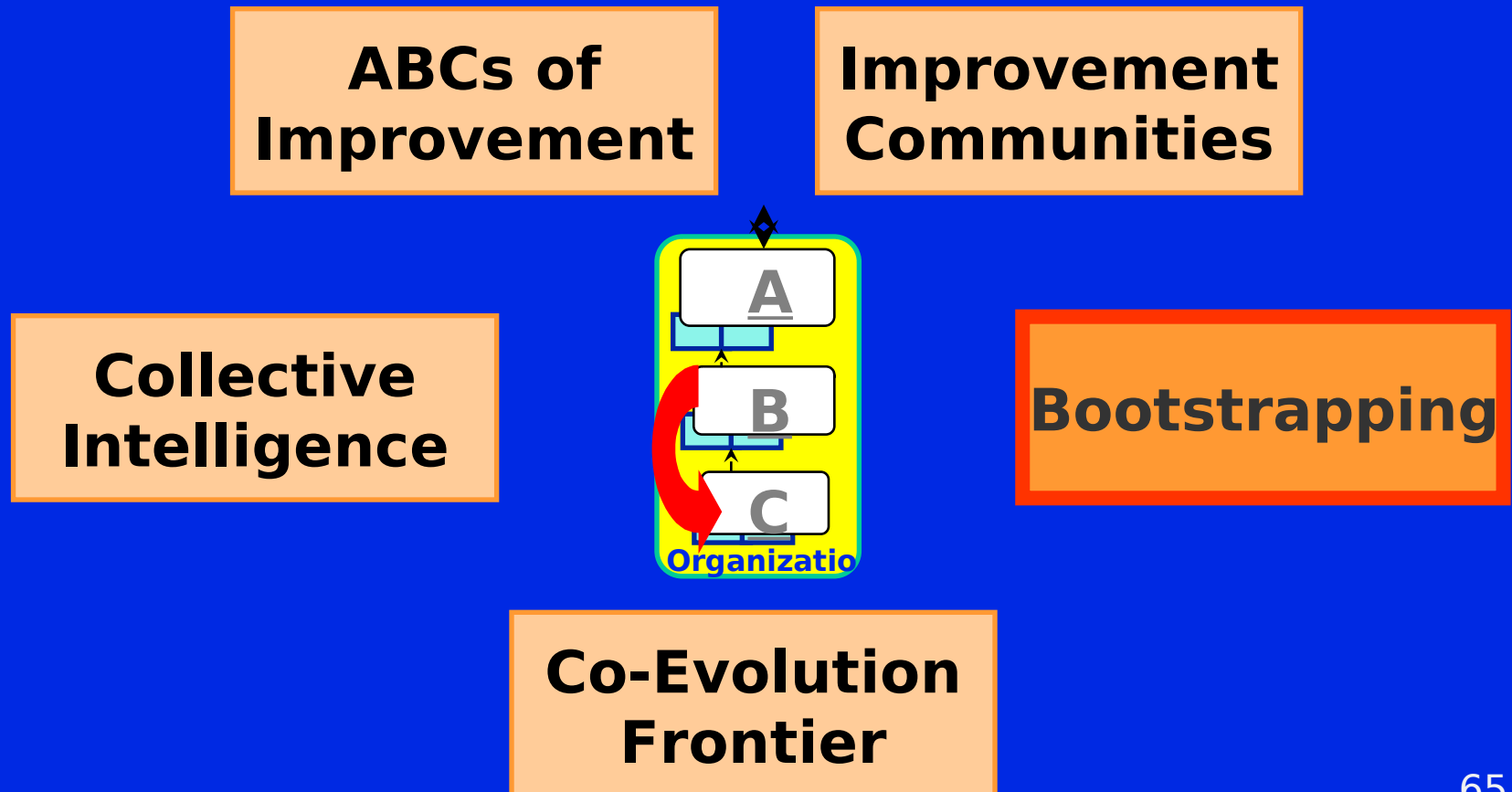


Knowledge Products

Intelligence Collections

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Going After the Opportunities

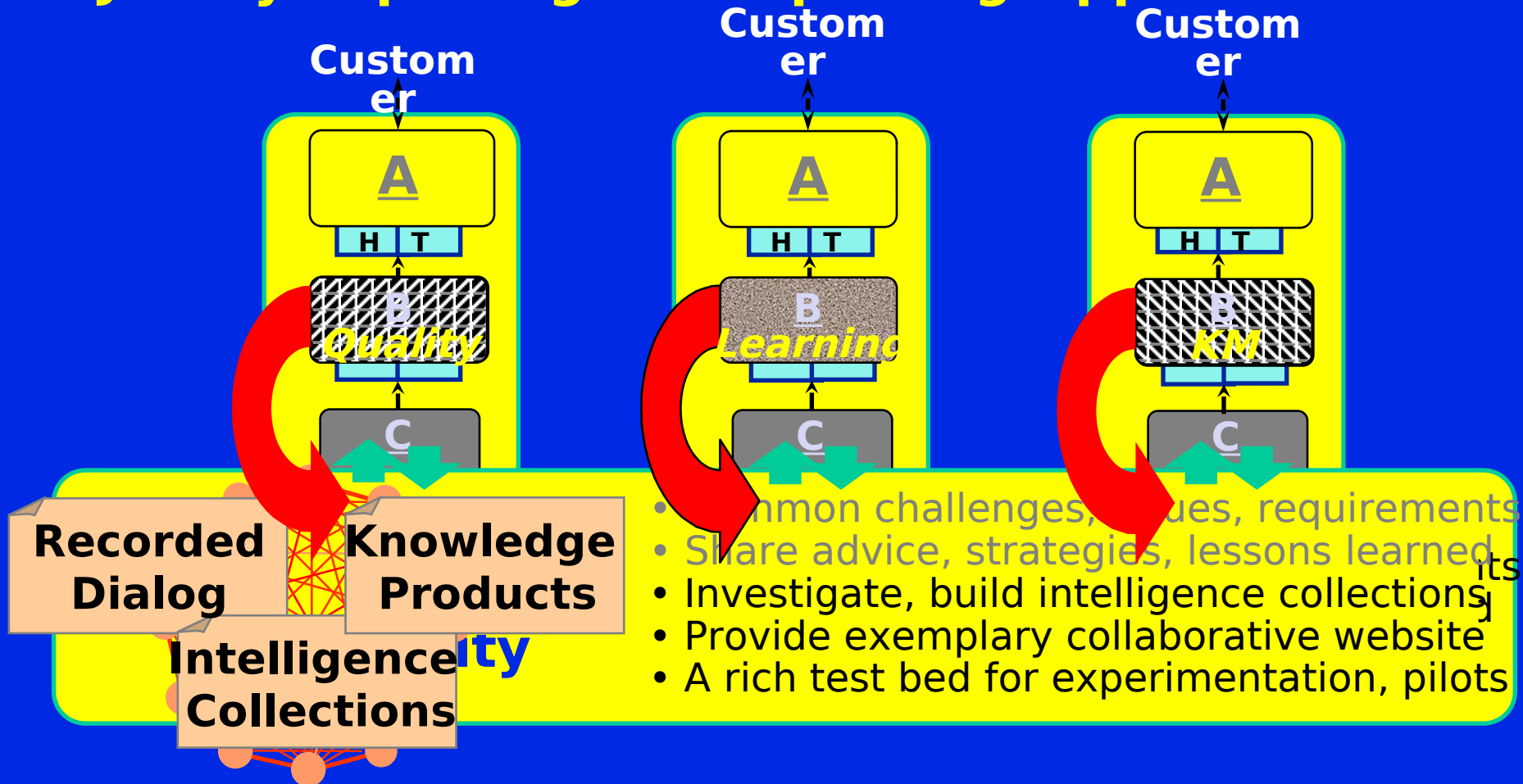


Putting It All Together



Forming a NIC of selected ACM SIGs

Jointly exploring the Exploding Opportunities



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Requirements for OHS -- an Open Hyperdocument System

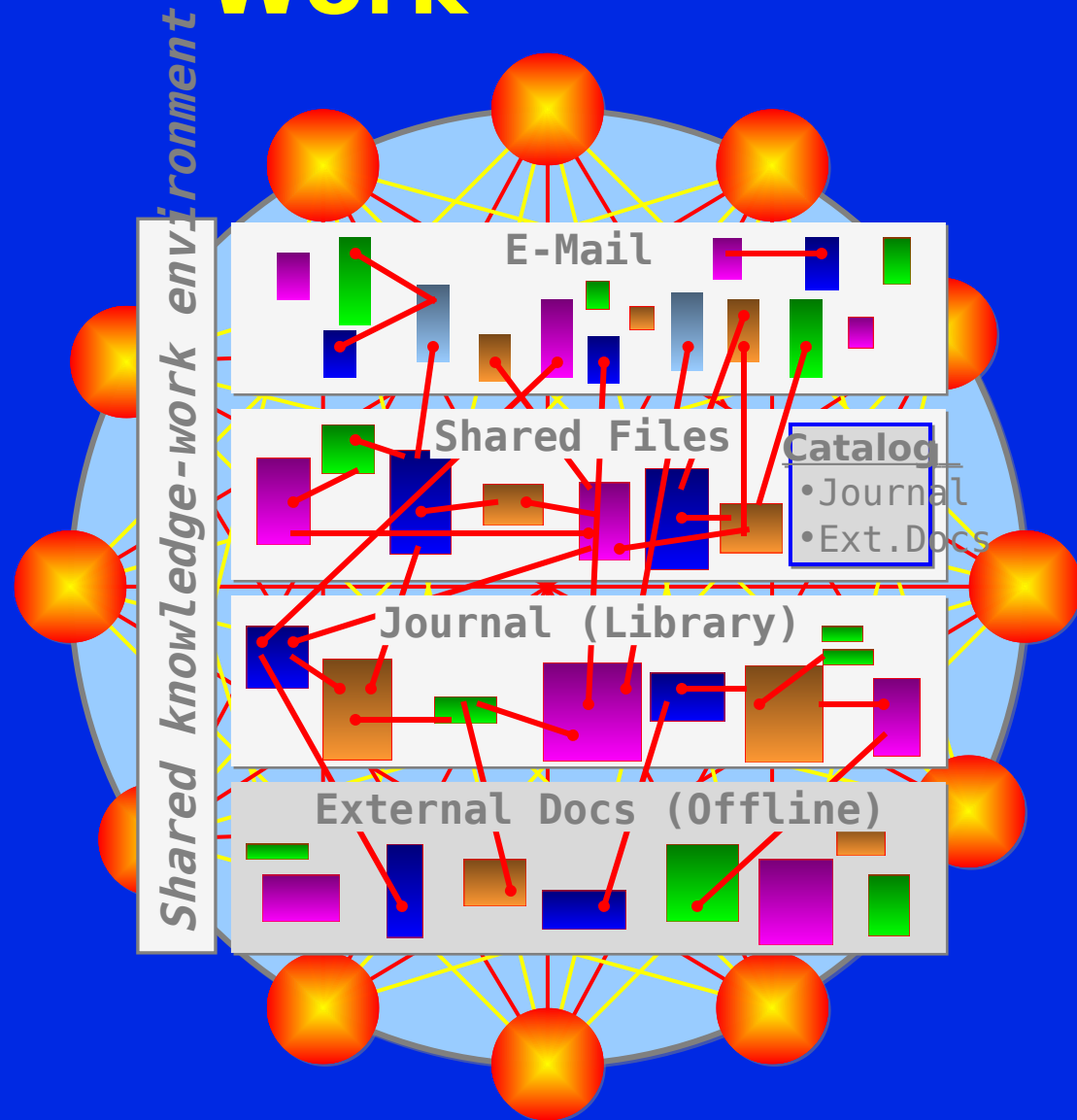
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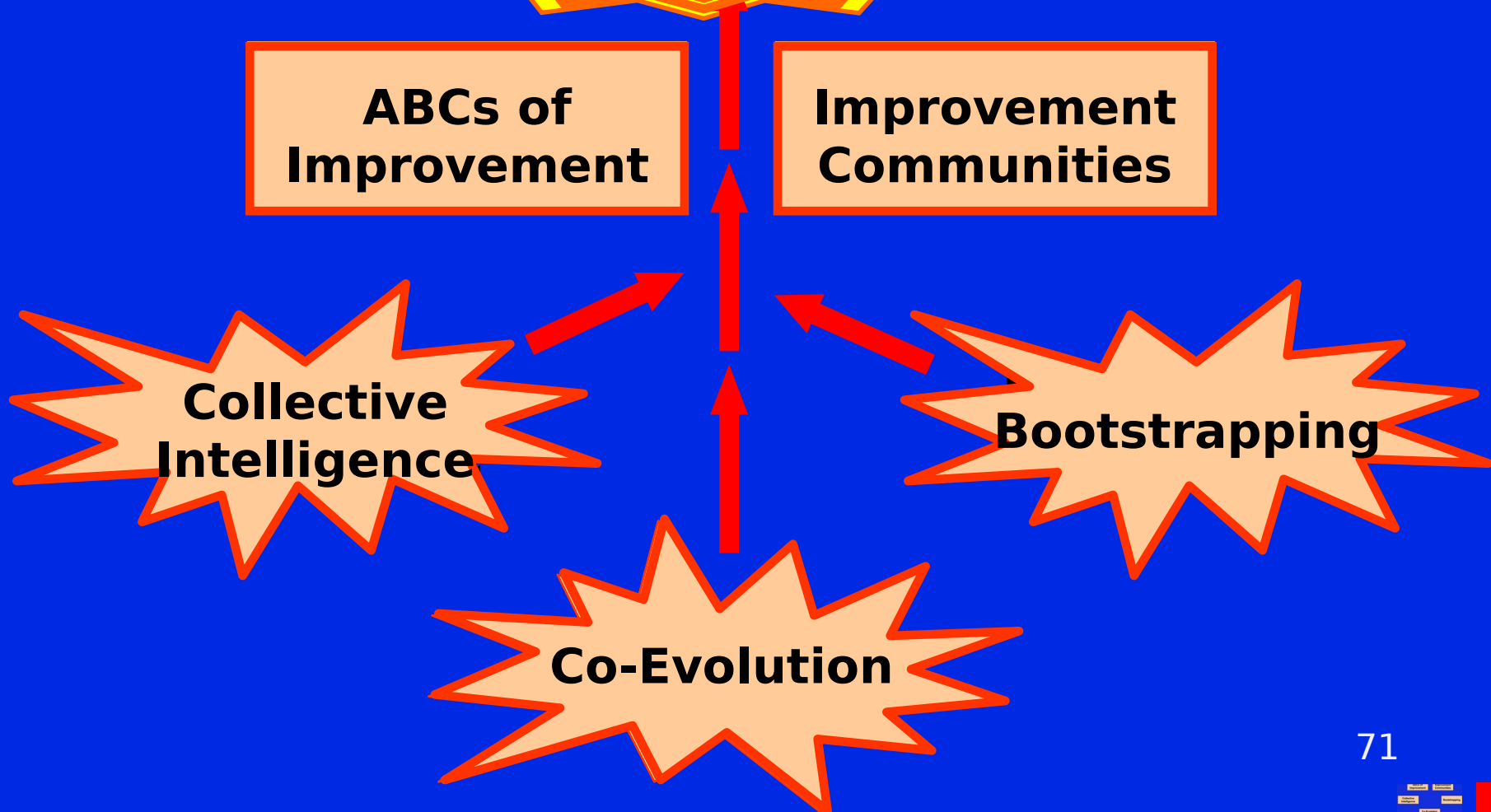
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OHS to Support Basic CoDIAC Work

- Structured
 - Object linking
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 - Shared Screens
 - Scripting
- CoDIAC
Example



Potential: Augmenting Society's Improvement Structure



END OF RECAP

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